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TABLE OF CONTENTS ON PAGE 2

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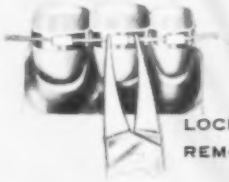

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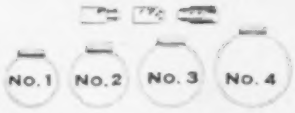

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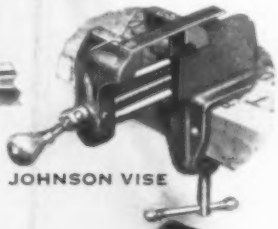

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CONTENTS FOR APRIL, 1948

American Journal of Orthodontics

Original Articles

Orthodontic Therapy as Limited by Ontogenetic Growth and the Basal Arches. J. A. Salzmann, D.D.S., New York, N. Y. ---------- 297

The Treatment of Malocclusion of the Teeth in the Light of Newer Knowledge. Samuel J. Lewis, D.D.S., Detroit, Mich. ---------- 320

Details of Management Conducive to Better Service and Patient-Clientele Relationship. Leonard P. Wahl, D.D.S., Wausau, Wis. ---------- 345

The Orthodontic Program of the Michigan State Department of Health With a New Classification of Occlusion for Survey Purposes. George R. Moore, D.D.S., M.S., Ann Arbor, Mich. ---------- 355

A Simplified Cephalometric Head Positioner. M. Alden Weingart, D.D.S., New York, N. Y. ---------- 362

Editorial

Socialized Medicine ---------- 367

In Memoriam

Howard Denton Keeler ---------- 368

Orthodontic Abstracts and Reviews

Orthodontic Abstracts and Reviews ---------- 369

News and Notes

New and Notes ---------- 373

Officers of Orthodontic Societies

Officers of Orthodontic Societies ----------378

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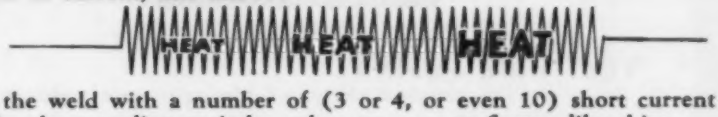

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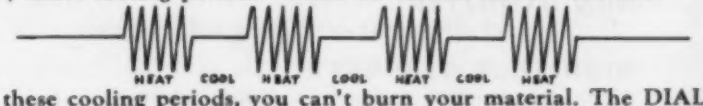

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VOL. 34 APRIL, 1948 No. 4

Original Articles

ORTHODONTIC THERAPY AS LIMITED BY ONTOGENETIC GROWTH AND THE BASAL ARCHES

J. A. SALZMANN, D.D.S.,* NEW YORK, N. Y.

INTRODUCTION

MECHANICAL procedure, which unfortunately has received overemphasis from the orthodontists themselves, is now accepted by the uninitiated as an end in itself rather than at its true value as one of a number of instrumentalities in the correction of malocclusion.

It is in order, therefore, to examine the definitive principles of orthodontic diagnosis in relation to genetic endowment, ontogenetic growth, development, and function and to recognize the inherent factors which limit the degree of successful treatment in individual cases of malocclusion, regardless of the type of mechanical appliance used by the operator. This paper is devoted to a discussion of the functional growth of the jaws from the standpoint of ontogenetics and the role played by the "Basal Arches," defined herein, in relation to treatment planning and the limitations of orthodontic therapy.

THE CONCEPT OF NORMALITY AND JAW GROWTH

The "Law of Variation"[1] of structure, form, and function is inherent in the human race; complete standardization would be incompatible with life. Adaptive variability of tissues and organs is necessary with age, sex, diet, occupation, climate, and other factors on which survival of an organism depends. However, the need for orthodontic treatment arises primarily because of morphologic deviations of the teeth and jaws beyond the limits of normality.[2]

Structure, form, and function may be considered within the concept of normality as long as they do not reflect a disease process.[3] Since there is no sharp dividing line between health and disease, the extremes in the range of natural variation present difficulties in clinical diagnosis. In the final analysis, "normal" as applied to structure, form, and function in orthodontic diagnosis

Read before the spring meeting of the Northeastern Society of Orthodontists, Atlantic City, N. J., March 2, 1948.

*Associate Dentist and Head of Orthodontic Clinic, Mt. Sinai Hospital, New York, N. Y.

falls well within the subjective responses of the individual orthodontist without direct relation even to arbitrary definitive criteria such as those based on so-called "standards."

Growth and development of the skull, like that of the skeleton in general, follow the law of "Developmental Direction."[1] This law holds that the more proximal parts of the body complete successively a greater percentage of their ultimate development and growth than the more distal sections. In compliance with this law, growth of the head is completed sequentially from the brain outward and from the cranium downward to the jaws and the face. The supraorbital ridges, whose increase in growth is related to masticatory stress and the relationship of the jaws to the cranium, are the only parts of the cranium to show active growth well into adulthood.[4] The greatest changes in the proportions of the skull are those which take place in the dentofacial region, especially in the jaws.[5]

At birth, the cranium has attained almost 65 per cent of its final adult size. By the end of the sixth postnatal year, the head achieves over 75 per cent of its final adult growth while stature attains approximately only 40 per cent of its final dimension. At the age of six years, the brain-case is almost of adult size while the jaws and face are still characteristically infantile.

Between the ages of 4 and 7 years, the forward growth of the frontal and parietal bones in the region of the coronal suture causes the forehead to appear higher and more vertical. At the same time, growth of the maxilla is translated mostly in a forward, downward, and outward direction so that the face appears more prognathous in relation to the cranium.

For the face to reach adult proportions, a relative as well as an absolute increase of dimension must take place in length over depth and width. The distance between *Nasion* and *Gnathion* more than doubles itself, while the relative and actual increase in depth from the *Tragion* outward renders the face more prognathous. Growth of the face is generally greater in males than in females, with the latter showing relatively greater increase in height and less increase in width and depth than males.[5]

At birth, the face equals about one-sixth of the entire skull, but in the adult it occupies about one-half of the skull. While this is true of ontogenetic development and growth, it does not hold true when regarded from the phylogenetic viewpoint. From the latter point of view, it is found that the cranium is enlarging at the expense of face size.

Weidenreich[6] found that "The transformation of the entire facial skeleton is associated with the development of the brain-case but in reverse directions. The brain-case tends to enlarge and to seize more and more, so to say, the region occupied by the facial skeleton. The latter loses its dominant position and finally appears as a relatively insignificant appendix to the now dominant brain-case. Hence, the reduction and transformation of the dentition is a part of and a correlative reaction in the process of alteration affecting the entire skull."

However, the reductive processes of the teeth and jaws are not always in consonance. The crowns of the teeth within the tooth germs, which are of ectodermal origin, are laid down in their final mesiodistal dimensions. The

jawbones, within which the tooth germs are lodged, are of mesodermal origin and show prefunctional growth in the intrauterine period, postnatal growth before the teeth erupt, and continue to grow until within the third decade of life. Since postnatal growth is influenced by environmental factors of a developmental, functional, and pathologic nature, the jaws with their inherent, evolutionary, reductive tendencies frequently do not achieve sufficient size to accommodate all of the teeth in an occlusal arrangement which falls within the range of normality from the morphologic, physiologic, and esthetic points of view. Lack of jaw growth, when it precedes tooth eruption, can produce impaction, crowding of teeth, and malrelationship of the dental arches.

Fig. 1.—Skull of a fetus. The trabeculae of the cancellous bone in the maxilla, malar, and mandible run in the direction of functional stress although the bones are still in their prefunctional state. (Courtesy, Dr. Spencer R. Atkinson, Pasadena, Calif.)

Differentiative growth of the face and jaws is not sharply defined but occurs gradually, and the various stages merge into each other. These changes involve increase in size, outline, and internal structural arrangement of each of the bones, their relationship to each other and to the cranium as a whole, so that at times jaw growth seems to stand still, when appraised by physical measurement, thus giving rise to the theory of "spurts" of growth.

The basic form of the jaws essentially follows the genetic pattern.[7] In the prenatal and prefunctional states, the form of the bony skeleton in the fetus develops under the stress of neuromuscular contraction and thus depends on the

balance between intrinsic factors and the stresses to which the developing bones are subjected. Dallemagne and Mélon[8] have concluded that the microscopic architecture of the bone in the prefunctional state is related to the vascular pattern rather than to external form or mechanical function. Examination of the histologic architecture in the jaws of the newborn, however, leads to the conclusion that even at this early stage form is well related to function.[9] This may also be true of the vascular system in relation to both form and function.[10] After birth, the genetic pattern of growth and development of the jaws is influenced by function, spatial relationship, especially with regard to posture, and intrinsic and extrinsic environmental forces of a metabolic and pathologic nature.

The maxilla comes into direct contact with all the other bones of the face except the mandible, although the latter is intimately related with it at the temporomandibular articulation. The anterior and lateral aspects of the maxilla form the part of the face which lies below the eyes to the maxillary teeth, part of the floor of the orbit, most of the roof of the mouth, and the floor and lateral walls of the nasal cavity.

Growth of the maxilla downward and forward takes place mainly at the frontomaxillary suture, at both ends of the zygomatic bone (mainly at the zygomaticotemporal suture), and at the pterygopalatine suture between the pterygoid process of the sphenoid and the vertical process of the palatal bone. Transverse growth of the maxilla takes place at the median palatine suture, by local apposition and resorption mainly at the alveolar processes, especially during tooth eruption, in the period of change from the deciduous to the permanent dentition, and by general developmental changes at the sutures of the facial bones. As the pterygoid processes of the sphenoid bone develop, diverge, and grow downward, there is also a forward and downward shifting of the maxillary bone.

Growth in length and height of the mandible takes place principally at the condylar growth center, which is gradually replaced by bone, while growth in length of the body of the mandible and width of the ramus takes place mainly by apposition. Appositional growth is especially active at the alveolar border and the distal surface of the ramus, while resorption takes place at the inner border of the ramus, lengthening the body of the jaw and the alveolar process distally and allowing room for the rotation of the maxillary permanent molars from a backward direction and the mandibular permanent molars from a forward direction, thus permitting the eruption of these teeth into the line of occlusion.

Brodie[11] found that incremental growth of the various components of the face follows parallel spatial planes. Thus, the plane of the palate, the plane of occlusion, and that of the base of the body of the mandible maintain a spatial parallelism as the facial bones and jaws increase in size. However, it should be recognized that while the gonial angle of the mandible does not change in size as growth proceeds, the angle described by the condyle with the base of the body of the mandible is subject to functional metabolic and other changes. This was shown by Engel and Brodie,[12] who stated that epiphyseal-like growth at the condyle persists until at least the twentieth year and provides the forward

and downward direction for mandibular growth and contributes also to increased width of the jaws. As pointed out also by Engel and Brodie, noxious influences such as endocrine disturbances, middle ear infections, arthritis, hematogenous infections, and others can affect the active cartilage center at the head of the mandibular condyle. Furthermore, these authors pointed out that injury to the condylar center results in growth arrest and consequent distortion of mandibular form and dental occlusion. All of these changes can and do influence the arrangement and occlusion of the teeth and the over-all shape of the mandible.

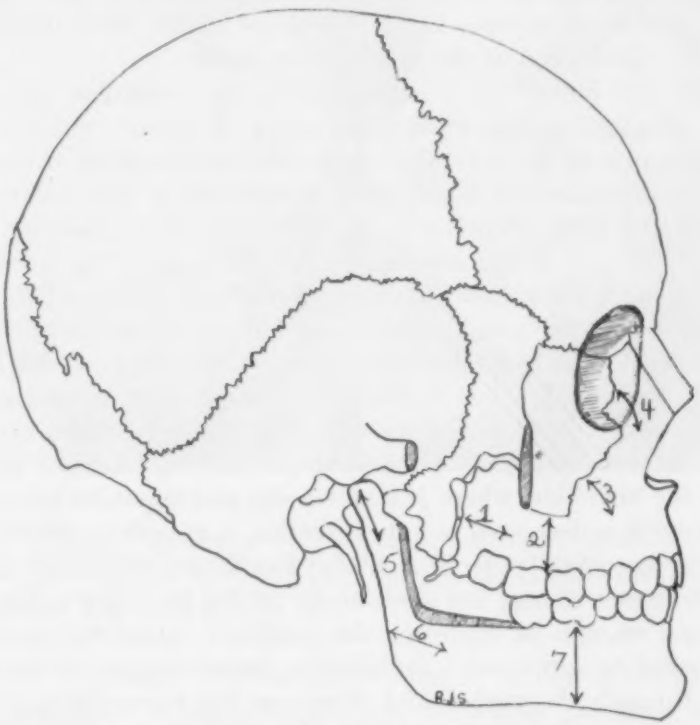

Fig. 2.—Profile view of skull showing main sites of growth in maxilla and mandible. *1*, Growth at the maxillary tuberosity at the pterygomaxillary junction. *2*, Growth at the alveolar process. *3*, Growth at the zygomaticomaxillary suture. *4*, Growth of the maxillary process in the floor of the orbit. *5*, Growth at the head of the mandibular condyle. *6*, Growth at the posterior border of the ramus. 7, Growth at the alveolar process. *Note:* The coronoid process of the mandible and part of the zygomatic bone have been removed to show the pterygomaxillary junction.

FORM AND FUNCTION OF THE JAWBONES

In addition to the genetic pattern, the morphology of a bone is established by the resultant load of stress generated in the various bone areas receiving sustained physiologic stresses.[13] Each bone as a unit is thus protected against minor forces which are too weak to overcome and modify the effect of the resultant stress.[14] If this were not so, bones would be subject to constant changes in morphology which would seriously interfere with the coordinated function of the skeleton.

Muscular power available for closing the jaws is much greater than for opening them. All the muscles of mastication take part in the closing of the

jaws, and the individual muscles of the group are developed according to the character and requirements of function. During mastication, each time the muscles which close the jaw bring the mandible upward, so that the mandibular teeth come into contact with the maxillary teeth, a new pushing or pressure force is exerted. However, since the resultant or over-all force which the facial skeleton can withstand is far in excess of the individual stresses produced during mastication, it can readily be seen why the jaws do not show over-all morphologic change as the result of mastication.

The extraordinary firmness of the jaws is far more than necessary to withstand the forces of mastication. Wetzel and Schröder[14] showed that the facial skeleton can withstand stresses nearly eighty to ninety times the average force exerted during mastication of the usual dietary foods.

Although the individual stresses exerted by muscular pressure during mastication, idle swallowing, when speaking or otherwise, will not change the over-all architecture of the jaws, the continued resultant force of muscular stress in the jaws is necessary for mandibular growth and is particularly influential before and during tooth eruption in the establishment of effective occlusal relations of the teeth and in the development of the jaws in the growing child in approximation with the genetic pattern. Growth of the mandible in complete or in partial anodontia, usually found in children with ectodermal dysplasia, can be explained by the fact that the muscles which open and close the mandible continue to function in jaw movement, including mastication, even in the absence of the teeth, and produce physiologic stimulation which enables the body of the mandible to achieve its physiologic growth pattern. In cases of early complete ankylosis of the mandible, where jaw movement and muscular action are absent, the rate of growth is decreased and the direction of growth is altered.

From the foregoing it can be seen that any stress, orthodontically produced or otherwise, cannot change the morphology of the jawbones unless the applied force is strong enough to overcome the resultant functional stress which the bone is prepared to withstand. Orthodontic forces applied to the teeth, acting as they do through the periodontal fibers on the surrounding alveolar bone, therefore, modify tooth arrangement by changing the contour of the alveolar process only. They do not change the over-all morphology of the respective bodies of the maxilla and mandible themselves.

INHERENT STRESS TRAJECTORIES OF THE FACE AND JAWS

In a study of the natural lines of tension of the skin and their effects, Langer[15] mapped out various planes of cutaneous tension by making holes in the skin of cadavers and noting the direction in which these holes were pulled when the skin was stretched. Langer found that operative disfigurement following skin incisions was minimized if the incisions were made parallel with the lines of inherent cutaneous tension. Langer's findings are currently accepted as a guide in surgery when making incisions of the skin.

The inherent lines of stress of the soft tissues of the face influence facial appearance. In Fig. 3 are shown two profile photographs of the same person (*A*) before and (*B*) after undergoing a plastic operation of the nose. The

arrangement of the teeth of the patient and the relationship of the jaws were not changed orthodontically or otherwise. Examination of the casts of this patient showed a mutilated Class II, Division 2 (Angle) malocclusion. It will be noted that the facial profile in its entirety was improved by rhinoplasty alone. This improvement is due directly to cutaneous and muscular tension and has nothing to do with the position of the teeth or with the relationship of the jaws.

A. *B.*

Fig. 3.—*A*, Profile photograph of a patient before undergoing rhinoplasty. *B*, Same patient as shown in *A* after undergoing rhinoplasty. Note the change in the tonicity of the mimetic muscles, especially the orbicularis oris. The patient has not received any orthodontic treatment, and the position and occlusion of her teeth have remained unchanged. (Courtesy, Dr. Bruno Griesman, New York, N. Y.)

The foregoing should be taken into account by the orthodontist who undertakes to change facial relationship and appearance by changing the occlusion of the teeth, regardless of the fact that extraction of the teeth may or may not be resorted to as part of treatment. While the appearance of the face is influenced by the morphology of the facial skeleton and the relationship of the jaws, it is to be seen that the muscles, skin, and other soft tissues also play an important part in the establishment of facial contours.

Benninghoff[17] studied the natural lines of stress in bones by piercing with an awl small holes into the bones of fresh skulls. He found that when the skull was dried, the holes pierced by the awl took linear form. These lines are the so-called "Benninghoff's lines" or trajectories, and show the inherent direction of functional stress in bone. These lines follow the osseous pattern exhibited by the cancellous bone or bony trabeculae of the spongiosa within the bodies of the respective jaws. Benninghoff showed that the cancellous and compact parts of a bone present an inseparable functional unit with the lines of stress passing alike through both types of bone.

Benninghoff's lines of stress or trajectories in the mandible, when observed in lateral view, are found to run essentially in parallel lines. A line of stress extends from condyle to condyle and passes across the symphysis along the compacta at the lower border of the mandible. Immediately above are additional parallel lines of stress which arise in the ramus on each side and run through the spongiosa. At the incisors, the lines of stress do not run horizontally but extend obliquely downward from the crest of the alveolar process and converge at the symphysis in the constricted part of the body of the mandible below the alveolar process.

In edentulous jaws, the lines of stress running to the incisors and the teeth in the buccal segments disappear with the alveolar process which held the teeth. However, the lines of stress in the subalveolar and supra-alveolar portion of the bones of the respective bodies of the maxilla and mandible remain.

Henckel,[18] who examined the skulls of animals with Benninghoff's method, found no significant difference in the natural trajectories of the face and palate of man, the chimpanzee, and the orangutan. He found, however, that the skull of the goat, an animal without incisor and canine teeth, exhibited no trajectories extending from these regions upward, while the trajectories or lines of stress in the molar teeth ran backward and upward to the occiput. This he presented as direct evidence of the far-reaching influence of muscular stress on the architecture of the skull.

When the skull is viewed obliquely from below, the entire facial skeleton is seen to be enclosed by Benninghoff's trajectories or lines of stress which extend fanlike from the median palatine suture, across the alveolar process, through the maxilla, and terminate at the base of the skull. The facial skeleton is thus firmly united with the brain case by a basketlike formation of lines of stress. These lines do not halt at the sutures of the individual bones but continue across the various facial bones as if the sutures did not exist, and finally become dissipated and disappear at the cranium. The disappearance of the stress lines is attributed to the strength of the vaulted frontal, parietal, and occipital bones which are strong enough to overcome and dissipate the stresses generated in the jawbones.

The maxilla, in its construction, like all bones, follows Wolff's[19] law and provides a maximum of strength with a minimum of material. Thus, the maxillary bones consist of thin plates of bone supported by strong bony thickenings that manifest themselves as buttresses which brace and stiffen the facial frame. The buttresses consist of three columns of bone on each side of the face and should be considered as a unit. They run through the upper component of the maxilla cranially to the base of the skull and bear the main stresses of mastication as indicated by the concentration of Benninghoff's lines of stress along their paths. The buttresses are classified as follows:

1. Anteriorly, the *frontonasal buttress* for the transmission of pressure from the region of the incisors, the canine, and partly from the premolar teeth, especially the first premolar. The lines of stress run cranially along the sides of the piriform aperture and the crest of the nasal bones to the frontal bone.

2. Laterally, the powerful *malar-zygomatic buttress* transmits stress from the buccal group of teeth. The malar bone and zygomatic arch also receive the

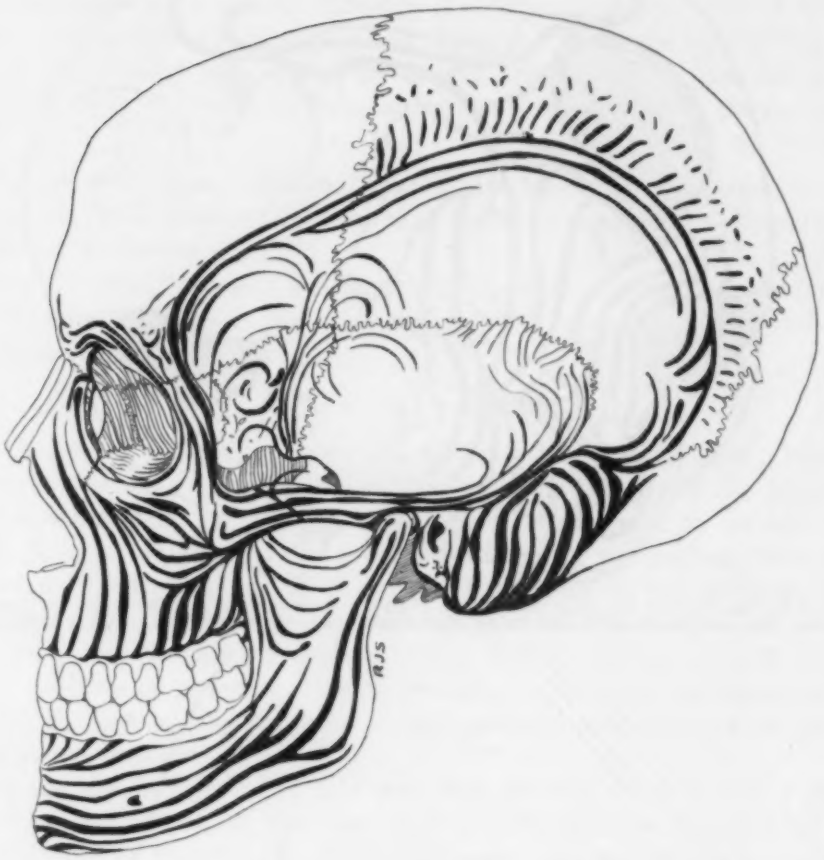

Fig. 4.—Profile of a skull, showing Benninghoff's lines of stress or trajectories.

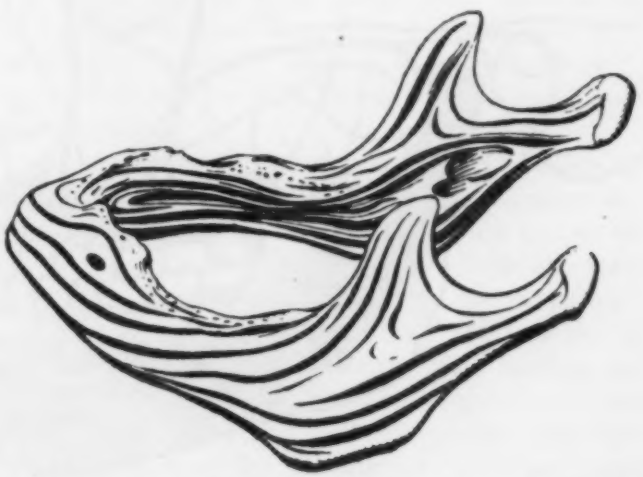

Fig. 5.—Benninghoff's trajectories in the edentulous mandible.

Fig. 6.—Oblique view of the base of a skull, showing Benninghoff's trajectories or lines of stress passing through the maxilla and being dissipated at the cranial bones. (After Benninghoff.)

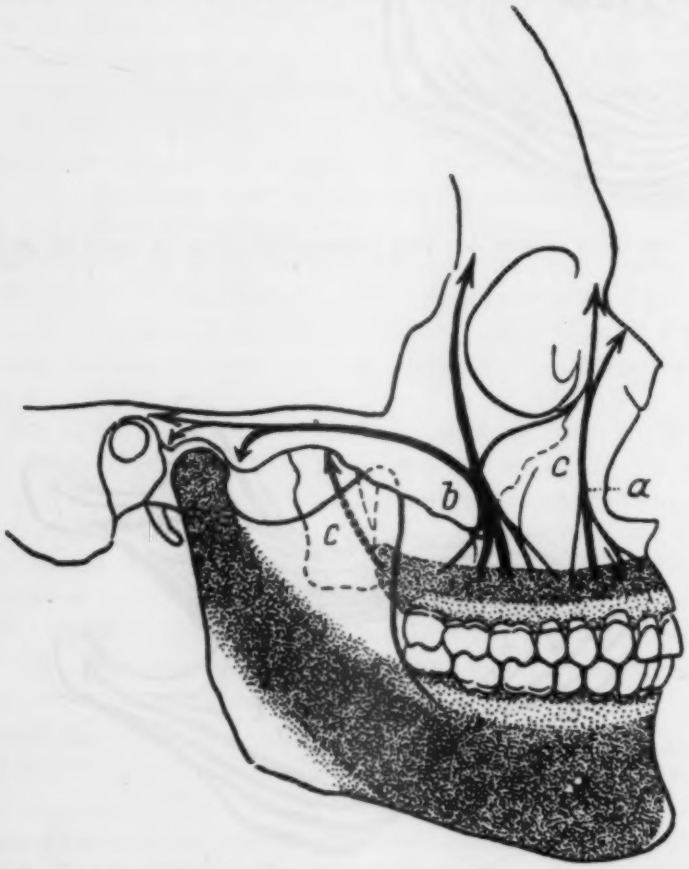

Fig. 7.—The basal arches of the maxilla and mandible and the distribution of the buttresses of the maxilla. The basal arches are the shaded portions of the jaws. (After Bluntschli and Schröder.)

stress of the masseter muscles. There is a separation of the lines of stress in the malar bone as follows: through the zygomatic arch to the base of the skull; upward to the frontal bone along the lateral orbital border, and, by a third, weaker path, along the lower orbital margin to the upper part of the *frontonasal buttress.*

3. Posteriorly, the *pterygoid buttress* forms a posterior elongation or curved support which passes around the choanae of the nasal cavity to the strong middle portion of the base of the skull.

Acting as crossbeams and auxiliary buttresses are, among other structures, the hard palate, the walls of the orbits, the zygomatic arches, the palatal bones, and the lesser wings of the sphenoid.

THE BASAL ARCHES

The muscles of mastication exert a pulling force on the mandible. However, the force exerted on a hard object, or when the contraction of the muscles of mastication brings some of the teeth or a portion of the gums, in the edentulous jaws, into forceful apposition, the resistance offered to the pulling force of the muscles of mastication is one of pressure. Resistance to this pressure is not confined to the local point of the mandible and maxilla directly at the zone of pressure, but comes in varying degrees from a fairly extensive area in the jaws where the pushing or pressure stresses, translated from the pulling stresses of the muscles of mastication, are received, concentrated, and transmitted through the entire facial skeleton.

While the alveolar processes hold the teeth through which pressure stresses originated by contraction of the muscles of mastication are transmitted from the mandible to the maxilla, the alveolar processes themselves are not actually the stress concentrating areas of the jaws. Such areas are located in the more or less constricted portions of the jaws subjacent to the alveolar process in the mandible and superjacent to the alveolar process in the maxilla. The area in each jaw which receives, concentrates, and transmits interjaw forces has been termed by Bluntschli and Winkler[20] the "basal arch," and has been recognized independently by Tweed,[21] although in a more limited sense, as "basal bone." The basal arch contains within its confines the "apical base" described by Lundström,[22] and includes also the area measured by Howes[23] in the diagnostic method which he has presented.

By far the greatest part of the entire mandible, including the body, rami, and condyles is occupied by the basal arch. Only those parts of the mandible which are subject almost entirely to direct muscle pull, i.e., where the muscles are actually inserted, can be considered as being outside the mandibular basal arch. Like the mandible itself, its basal arch is almost parabolic in outline extending from condyle to condyle with its high point at the mental region. The heaviest part of the basal arch lies under the tooth-bearing area in the body of the mandible, where it occupies an almost rectangular cross section between the outer and inner cortical plates, and contains spongy, medullary bone. The extent, location, and strength of the mandibular basal arch explain the role which the lower jaw plays in transmitting pressure.

Fig. 8.—The area covered by the basal arch in the mandible (shaded portion).

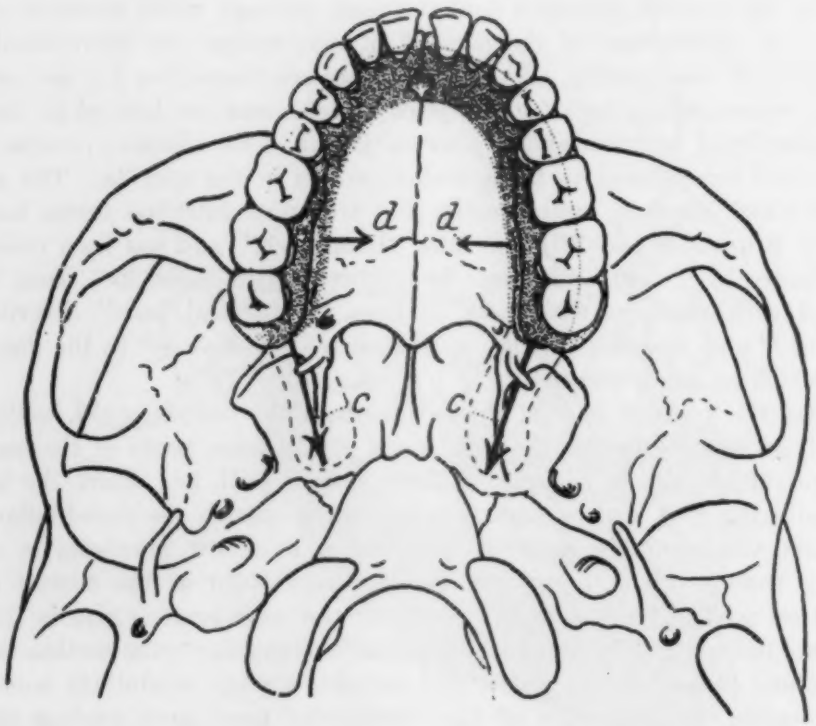

Fig. 9.—Palatal view, showing the extent of the maxillary basal arch.

In the maxilla, the basal arch does not cover an area as extensive as that covered by the mandibular basal arch. Its borders are continuous with the outer and inner cortical plates superjacent to the alveolar process at the level of the hard palate. The buttresses of the maxilla which show a concentration of Benninghoff's lines of stress originate in the maxillary basal arch.

In the infant who uses his mandible in a hingelike manner, there exists, as a rule, a distal relationship of the jaws. During natural breast feeding, when the mandible is brought upward against the mass of areolar tissue and nipple to express the milk through the nipple, the lower jaw also comes forward, bringing the mandibular basal arch directly under the maxillary basal arch.

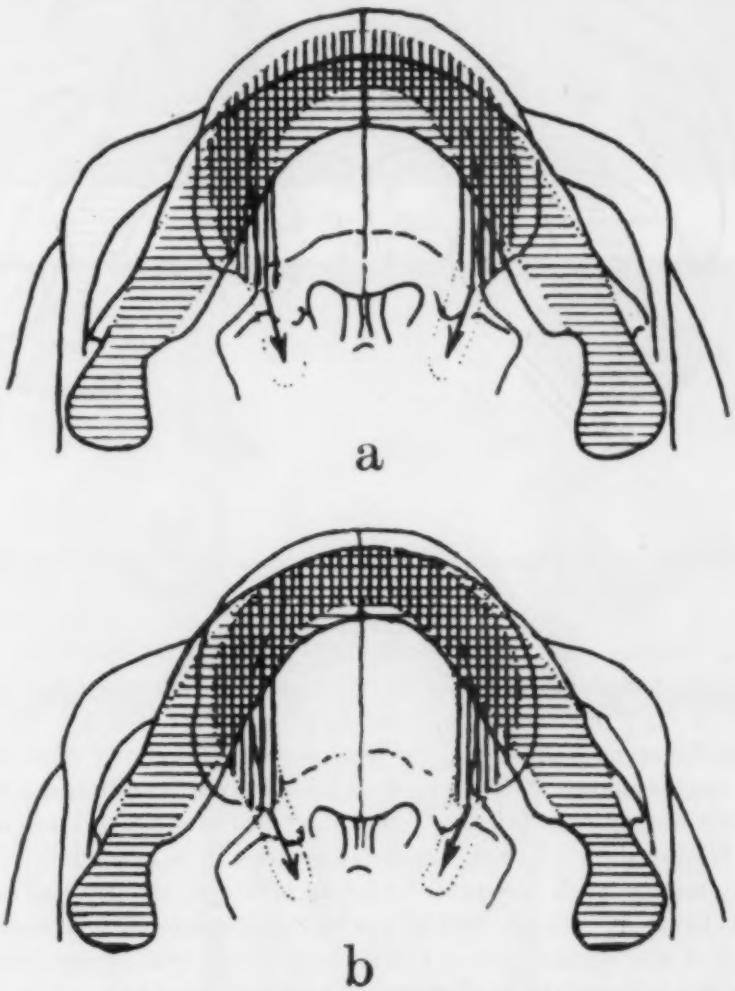

Fig. 10.—Relationship of the maxillary and mandibular basal arches in the newborn at rest (*a*) and with the mandible in forward position when nursing (*b*). (Mandibular basal arch shaded by horizontal lines. Maxillary basal arch shaded by vertical lines.)

With the contraction of the muscles of mastication, pressure is transmitted from the mandibular basal arch to the maxillary basal arch, where it is distributed through the buttresses and dissipated at the cranium. The basal arches, being part of the bodies of the respective jaws, exist before the teeth erupt, and remain throughout life as part of the jaws even when the teeth and alveolar

processes are lost. When the deciduous teeth erupt and the temporomandibular articulation is established on a more exact basis, the intermaxillary relationship of the basal arches becomes fixed and the stress lines demonstrated by Benninghoff are definitively established.

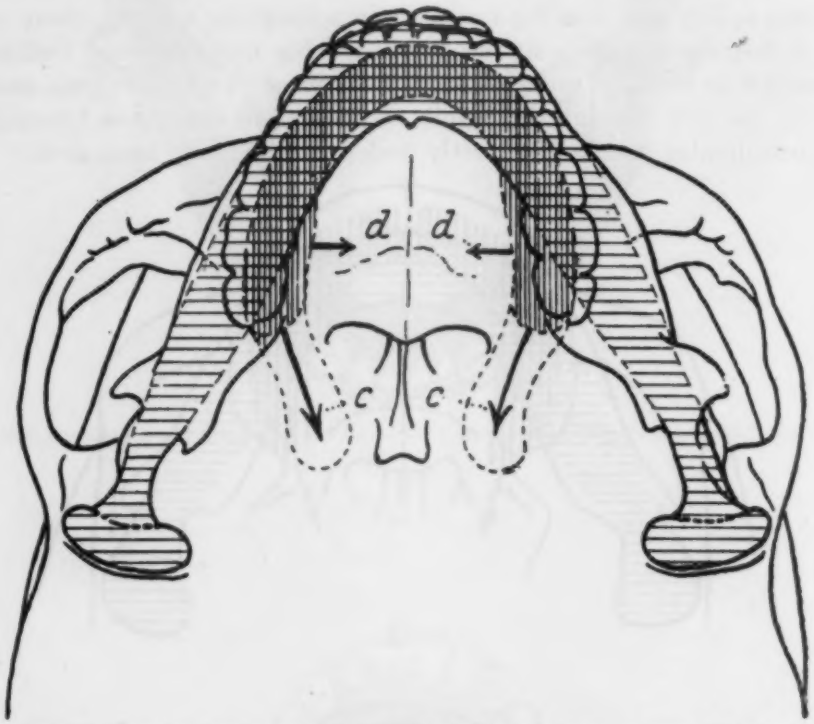

Fig. 11.—Relationship of the maxillary and mandibular basal arches in the adult with the teeth in normal occlusion.

It is the relationship and size of the basal arches that determine the pattern of distribution of the lines of stress for the transmission of pressure through the facial skeleton. In the absence of local interferences which are strong enough to overcome inherent tendencies, the permanent teeth must perforce arrange themselves in consonance with the lines of stress of the jaws in order to maintain a state of functional equilibrium. When the basal arches are large enough and in proper relationship, i.e., not too distal or mesial to one another, and other local factors are too weak to exert interfering influence, the teeth attain a normal occlusal arrangement. To the contrary, when deficiencies exist in the size and/or relationship of the dental arches, the state of functional equilibrium in consonance with the inherent lines of stress of the jaws may have to be obtained at the expense of normal tooth arrangement, producing malocclusion. It will be recognized, of course, that this is only one albeit a major cause of malocclusion.

Shifting of the remaining teeth after extraction represents an attempt to re-establish the inherent functional and morphologic balance dictated by the inherent lines of stress of the jaws. The size and relationship of the basal arches and their inherent lines of stress dictate the extent and direction of post-

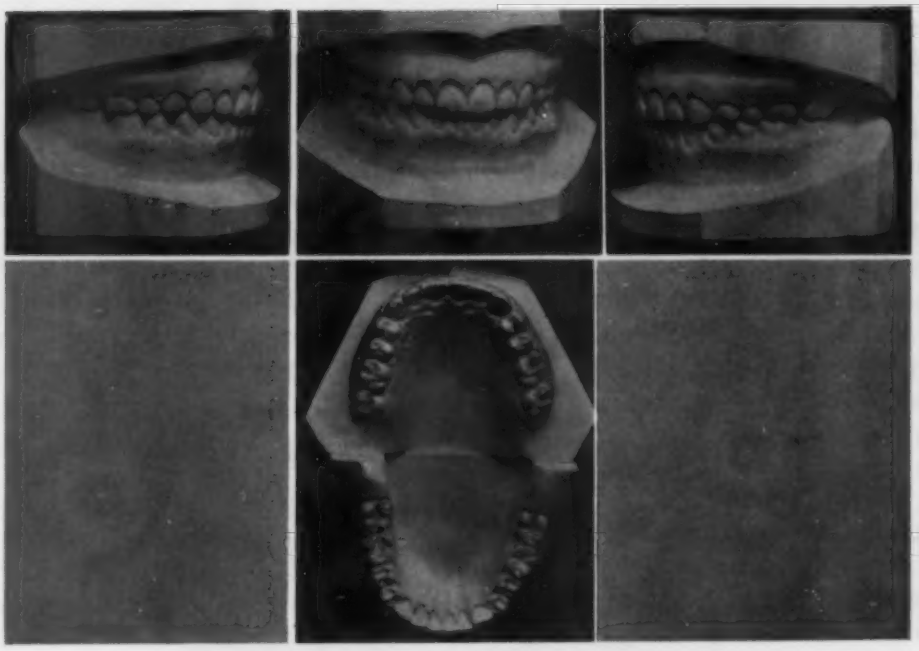

Fig. 12.—Normal occlusion and a normal basal arch.

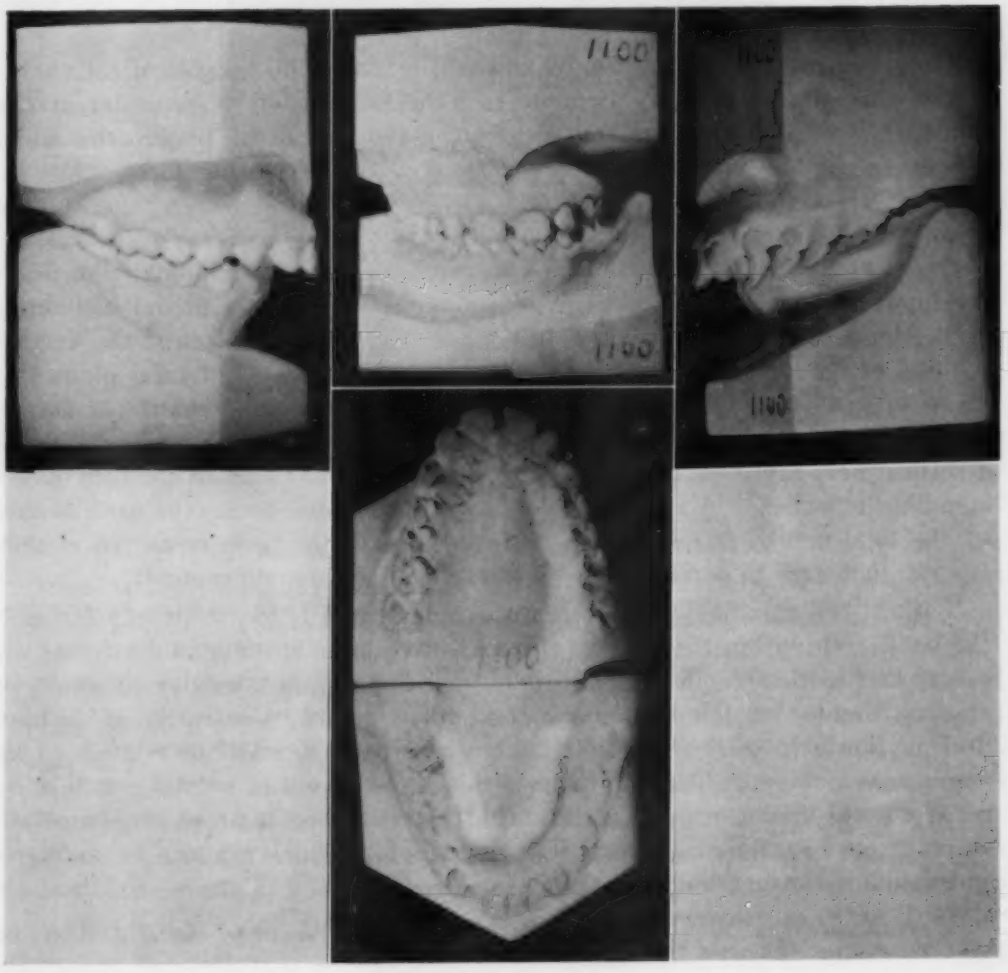

Fig. 13.—Malocclusion with spacing of teeth, procumbency of the mandibular incisors, and a constricted apical base.

extraction changes which manifest themselves in shifting, rotation, inclination, and continuous eruption of the teeth adjacent to the space left by the extraction. This brings about loss of occlusal and proximal contact and functional modifications during mastication. The same hold true of "collapse" changes in the dental arches after tooth movement by orthodontic means when the teeth are moved into a position in conflict with the inherent lines of stress as established by basal arch relationship. The degree of collapse depends directly on the extent to which the inherent lines of stress have been interfered with by the operator.

JAW MORPHOLOGY AND DENTAL MALOCCLUSION

There are many conditions of malocclusion which are due to local disturbances of alveolodental origin. These malocclusions may be treated according to any of the accepted methods of orthodontic tooth movement. However, the real problems in malocclusion which the orthodontist is confronted with are those involving arch length and arch relationship. As originally stated by Mershon,[24] "The orthodontic problem is not a tooth problem—but must be studied from the standpoint of development and its relation to functional forces."

Assisted by the upright posture assumed by man, and because of the curved or bow-shaped form of the mandible and the location of its muscular attachments from which muscular pull originates, the horizontal trajectories which run along the lower border of the mandible exert a spreading force, while the lines of stress running through the basal arch toward alveolar bone and the teeth exert a compressive action. The resultant of these forces is responsible to a great extent for the widening of the mandible at its intergonial dimension, the forward translation of the chin, the lingual and slightly mesial inclination of the long axes of the mandibular teeth in the buccal segments, the vertical position of the mandibular incisor teeth in relation to the mandibular plane (the plane tangent to the base of the mandible), and the maintenance of correct proximal contact of the mandibular teeth. However, tooth arrangement as described here can occur only when the size of the basal arch in the body of the mandible is sufficiently large in relation to the coronal arch (the arch formed by the total mesiodistal dimension of the crowns of the teeth measured at their longest diameter) to permit the teeth to assume normal arrangement.

When the maxillary or mandibular coronal arch is too small in relation to the basal arch within the body of the respective jaws, spacing or diastemas will occur, and tooth arrangement will depend primarily on muscular pressure, including tongue size, jaw relationship, and other factors. Contrarily, if the basal arch in the body of the mandible is constricted or too small in relation to the coronal arch, the mandibular incisors will be crowded out of normal arrangement or, if normal arrangement is maintained, they will show a procumbent relationship to the mandibular plane.* The degree of procumbency can be measured in relation to the mandibular plane.[25]

*Procumbency is accepted to be present when the angle formed by the incisors with the mandibular plane is greater than 90°.

Lundström[22] showed that establishment of a normal occlusal arrangement of the teeth has no effect in developing a deficient apical base and that, when the apical base is deficient, crowded teeth moved by orthodontic means into an accepted normal arrangement will show subsequent collapse when retainers are removed. He stated this premise in the following: "Since in an ontogenetic sense the occlusion is not able to control the apical base, while on the other hand the latter is in a high degree capable of affecting the occlusion, it is necessary, instead of regarding from a therapeutic point of view the anomalies of the positions of the teeth as simply or principally occlusional problems, henceforth to regard them as being in an equal degree problems of the apical base, and the object of treatment will be the attainment of an occlusion (in harmony with the given or potential apical base) possessing a functional and hygienic optimum. . . . The most urgent duty of mechanical orthodontics, therefore, is to endeavor to determine how in every given case such an optimum is to be attained."

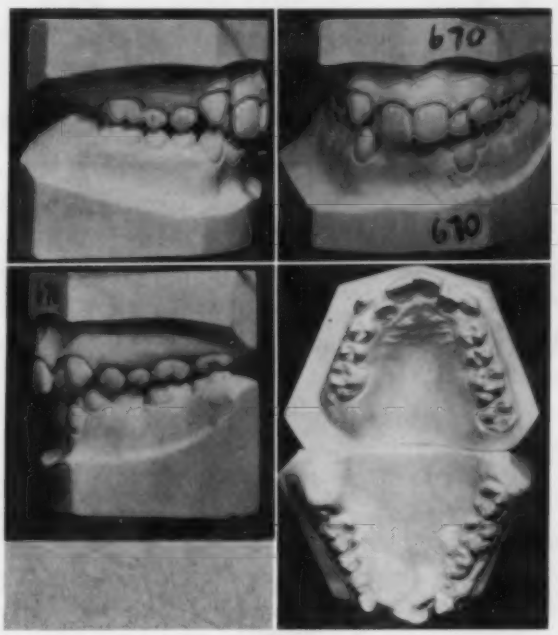

Fig. 14.—Crowded dental arches in a child 12 years of age. Attempts to move the teeth into normal alignment without reducing the mesiodistal dimension of the coronal arches by extraction will result in procumbency of the incisors and an unstable relationship of the teeth.

While the size, form, and relationship of the basal arches are independent of the size of the teeth, tooth arrangement is greatly dependent on the size of the basal arches, on their relationship to each other, and, ultimately, on the distribution of the inherent lines of stress of the jaws. Therefore, teeth moved into so-called normal arrangement by orthodontic means will not show permanency of position when the basal arch is not sufficiently large to permit such teeth to occupy the new location without being in conflict with the intrinsic lines of stress of the jaws. This confirms Tweed's[26] observation that "The irregular dentition in balance is a far more stable condition than the same dentition

treated orthodontically but forced out of balance and into protrusive relationship to the medullary portion of the bony base. Such orthodontic treatment is usually followed by 'collapse.' ''

Success in orthodontic tooth movement, therefore, is, among other factors, dependent on the size of the basal arches in relation to the coronal arches. When

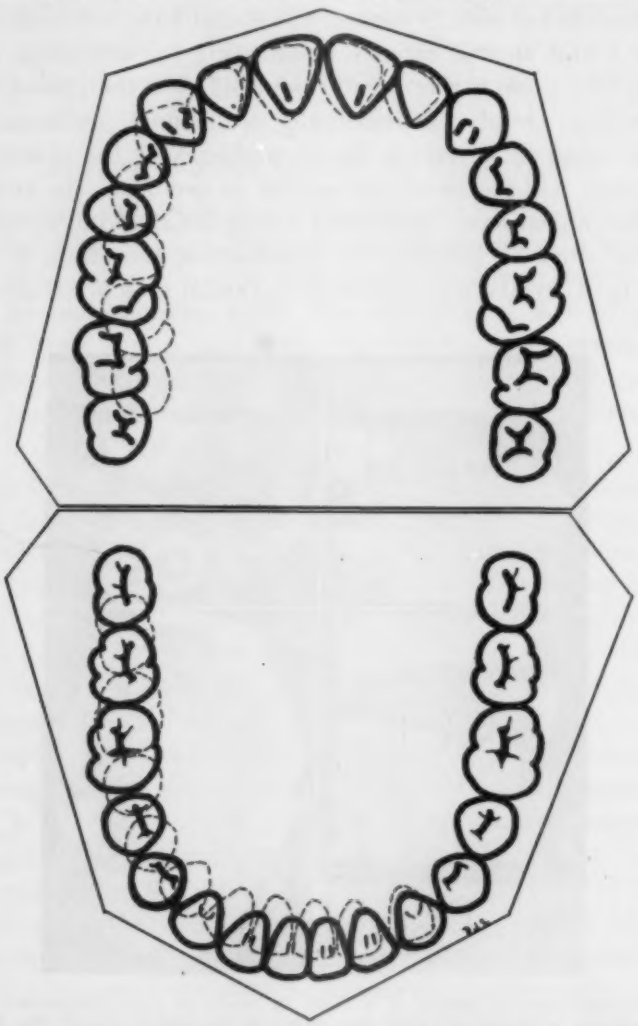

Fig. 15.—Outline drawing showing normal dental arches (heavy solid lines) and shifting of the teeth following extraction of the permanent first molars and closure of the space (thin broken lines). In the maxillary arch, there is a shifting of the incisor teeth to the side from which the permanent first molar was extracted, a slight distal shifting of the canines and premolars, and a decided forward shifting of the second and third molars. At the same time, there is a flattening or collapse of the arch lingually on the side of the arch from which the first molar was extracted.

In the mandibular arch there is a slight shifting of the incisor teeth to the side from which the permanent first molar was extracted. There is also a lingual collapse of the canine and incisor teeth which results in an increased overbite. The premolars rotate and incline as they shift distally and show spacing between them. The second and third molars shift mesially and show some rotation and much inclination, but there is no collapse of the premolars and molars in a lingual direction.

the basal arches are of insufficient size in relation to the coronal arches to permit crowded teeth to remain in normal arrangement, after they have been thus aligned by orthodontic means, without bringing them into conflict with the inherent lines of stress of the jaws, a reduction in the size of the coronal arches

is in order. Such reduction has been advocated by Case,[27] Grieve,[28] and, latterly, by Tweed,[26] who advise extraction, usually of the first premolars.

Tooth extraction as an adjunctive measure in orthodontic procedure is not to be regarded as a short cut or compromise in overcoming crowding of individual teeth or even of groups of teeth. Extraction is to be resorted to only when the basal arches are too constricted to permit normal arrangement of the teeth without bringing them into conflict with the inherent lines of stress of the jaws. Extraction is related to obtaining normal arch relationship and improving facial appearance, rather than to convenience in the reduction of crowding of teeth.

In a series of studies[29] dealing with the shifting of teeth after extraction when not followed by orthodontic control, it was found that extraction per se cannot be relied upon to correct crowding of teeth nor can extraction be resorted to successfully as a sole means for the elimination of malocclusion as it manifests itself in the various classifications established by Angle.[30] In those cases which showed improved occlusion after extraction, such improvement was purely accidental and the result of other favorable conditions present in the mouth which did not permit the usual promiscuous shifting of the remaining teeth in the arches, but guided them instead into a favorable relationship.[31]

ORTHODONTIC PROCEDURE IN RELATION TO ONTOGENETICS

It can be seen from the foregoing that (1) the extent of successful orthodontic tooth movement that can be obtained in the individual patient is greatly dependent and totally limited by ontogenetic growth of the jaws and (2) where the basal arch is not large enough in relation to the coronal arch, the coronal arch must be reduced by the extraction of teeth.

The questions now arise: (1) What are the criteria by which we may determine the deficiency of the basal arches; (2) is extraction always indicated when such deficiency exists; and (3) is basal arch deficiency the only reason for extraction in orthodontic procedure?

BASAL ARCH DEFICIENCY AND ORTHODONTIC PROGNOSIS

It should be observed that it is possible to have procumbency of the mandibular incisors without a constricted or deficient basal arch, as, for example, when the orbicularis oris and the other facial muscles, including those used in mastication, are underdeveloped and of poor tonicity while the tongue is large and tongue action is strong. Where the ramus of the mandible is short, as indicated when a line drawn tangent to the mandibular plane passes through the occipital bone, instead of tangent or almost tangent to that bone, as suggested by Atkinson,[9] the mandibular incisors may appear to be in procumbent relationship but will frequently be found to be at 90° or less to the mandibular plane. In cases of this type, when the basal arches are constricted, although tooth alignment is normal and procumbency of the mandibular incisors is not present, extraction may prove beneficial, as far as facial esthetics are concerned. However, where the basal arches are normal, extraction for facial esthetic effects may result in residual interdental spacing when retaining appliances are discontinued, without lasting improvement of the facial profile.

When the incisor teeth in different mandibles are viewed in cross section, a great variety of relationships can be seen between the body of the mandible, including the basal arch on the one hand and the teeth and their alveolar process on the other. In some mandibles, the entire dental arch may be situated linguad to the body and base of the mandible with the latter showing an outward flaring to varying extent. Contrarily, in other mandibles the dental arch and its alveolar process may be situated in a more buccolabiad relation to the body and base of the mandible itself. Both types of jaws may or may not have a deficiency of the basal arch with or without crowding of the anterior and/or posterior teeth.

F. *E.* *D.* *C.* *B.* *A.*

Fig. 16.—Cross section showing different stages of development of the mandibular permanent incisor and growth of the alveolar process and of the body of the mandible. *A*, Two months; *B*, seven years; *C*, nine years; *D*, eleven years; *E*, sixteen years, and *F*, twenty-five years. *Note:* Allowing for the variation in growth patterns of different jaws, we can, nevertheless, observe the tendency of the body and base of the mandible to show increased growth with age. The growth pattern of the body of the jaw, especially in an anterior direction, is an important factor in determining the presence of a constricted basal arch. (Courtesy of Atkinson, Spencer R.: AM. J. ORTHODONTICS AND ORAL SURG. 28: 704, 1942.)

Regardless of the size and location of the dental arch in relation to the base of the mandible itself, a deficiency of the basal arch can manifest itself as follows:

1. When the anterior and posterior teeth show normal alignment in the dental arch, there will be a procumbency of the incisor teeth in relation to the mandibular plane. There will also be present a prominent inverted or "Simian" shelf, running from the alveolar process to the basal arch.

Extraction of teeth in the above type depends on the degree of labiodental protrusion manifested in the profile of the patient. If the dental arch is situated

far enough in a linguad direction so that existing procumbency of incisor teeth will not aggravate the protrusion of the lips and cheeks and produce an unbalanced profile, extraction becomes a purely subjective procedure to be resorted to at the discretion of the patient or those responsible for the patient, if such a decision is not entirely contrary to the judgment of the operator with regard to its adverse effect on the health of the teeth.

It was pointed out by Case,[27] "All of that large class of cases whose teeth are in *normal occlusion*, but with overlying facial contours, protruded or retruded to a deforming extent, should be regarded as *malocclusions, demanding correction*,—if the science of Dental Orthopedia means anything beyond the mere correction of irregularities of the teeth for mastication alone." However, to argue that the incisors, although in regular alignment, must be positioned at 90° to the mandibular plane even if the profile is good or is acceptable to the patient and his parents is to allocate to oneself the arbitrary decision as to what constitutes beauty.

Fig. 17.—Superposed profile tracings showing area of facial change following extraction of first premolars and orthodontic correction of bimaxillary dental protrusion.

2. When the anterior and/or posterior teeth are crowded with or without procumbency of the mandibular incisors and the basal arch shows the presence of the "Simian" shelf, i.e., there is an extreme subalveolar constriction, attempts to arrange the teeth in normal occlusion will result an increase in the size of the "Simian" shelf and in the procumbency of the incisor teeth in relation to the mandibular base, bringing about a dentoalveolar protrusion, extraction should be resorted to if a favorable termination to orthodontic mechanotherapy is desired. Orthodontic therapy without extraction in this type results in the positioning of the teeth in conflict with the inherent lines of stress of the jaws.

When these stresses exert themselves, there is a tendency to re-establish the state of equilibrium in malocclusion which existed before treatment, and "collapse" follows regardless of how long retainers or other appliances are worn.

SUMMARY

1. Diagnosis of malocclusion is not to be based on subjective, arbitrarily established criteria or "standards," but must take into consideration the genetic endowment, ontogenetic growth, and postnatal development of the individual patient.

2. The stress produced by muscle or by orthodontic appliances exerting pressure on the teeth will not change the basic architecture of the jawbones as long as these forces are not strong enough to overcome the resultant stress which the jaws are able to withstand.

3. Facial appearance is influenced by the soft tissues as well as by the relationship of the underlying bones and the occlusion and axial position of the teeth.

4. The movement of a tooth or a number of teeth by orthodontic means, or otherwise, into a different occlusal relationship, whether normal or abnormal, will not change the form of the basal arch, which is an intrinsic part of the over-all morphology of the jawbone, even when the alveolar process itself which follows the teeth is changed as a result of orthodontic tooth movement.

5. Orthodontic tooth movement which brings the teeth into conflict with the intrinsic lines of stress of the jaws, as evidenced by the relationship of the teeth to the basal arch and their angular relation to the base of the mandible, results in collapse.

6. Criteria are provided for the indications and contraindications for extraction from the ontogenetic and facial esthetic points of view.

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THE TREATMENT OF MALOCCLUSION OF THE TEETH IN THE LIGHT OF NEWER KNOWLEDGE

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A biologist can do 2 things besides discovering facts of human evolution and genetics. He can tell his fellows how to achieve ends which they desire already, such as the cure or prevention of disease. He can tell them of possibilities at which they had not guessed, such as the possibility of making childbirth painless, or some of the possibilities of which I shall speak later. But he can never tell them what is worth doing. That is always an ethical, not a biological question. In what follows, I shall say that I think certain things are worth doing, that it is better to be born with a normal mouth than a harelip, with a normal color sense than color-blind, and so on. These are my opinions as a human being. If you disagree with them I cannot, as a biologist, persuade you to change your opinion. But, if you agree, then, as a biologist, I may be able to help you to work for the ends on which we agree.—*J. B. S. Haldane.* (Copyright, *The Atlantic Monthly,* March, 1947.)

IN 1911, it was my privilege to be a member of the last class in the last course given by Dr. Edward H. Angle in what was then known as the Angle School of Orthodontia. The clash of personalities between Dr. Angle and Dr. Calvin S. Case over the extraction of teeth in orthodontic therapy had then all but subsided, and to all intents and purposes Dr. Angle had been declared the winner. However, if the truth is to be known, both men had resorted to extraction in treatment prior to the publication in 1907 of Angle's seventh edition of his *Malocclusion of the Teeth.*

When the sixth edition[1] of Angle's book was published in 1900—a year that marked the graduation of the first class of orthodontic specialists from his school—he was still of the opinion that there were two reasons for extracting teeth in the treatment of malocclusion. These were, as he stated them: "(1) Where the jaws are so small, either naturally or because of arrested development, that the angles of inclination of the teeth would be too great if all the teeth were placed in line. (2) Where extraction is necessary from the requirements of facial lines, for the development of the arches may be such as to afford an abundance of room for the malposed teeth, and yet the placing of them in the line of occlusion may result in a marked dental or labial prominence."

In the light of later knowledge, these were prophetic words of wisdom from a man who, in the strictest sense, was not a scientist, but a prodigious, intuitive thinker.

In the interval between the publication of the sixth and seventh editions of his book, Dr. Angle developed the concept of perfect relations of the inclined

Read before the Northeastern Society of Orthodontists, New York City, March 10, 1947.

planes of the teeth which he erroneously called "normal occlusion." Thus was born that philosophy of the full complement of teeth which became the "orthodontic law," and which was to influence orthodontic practice for the next twenty-five years. It was to become, and still is, with certain modifications, the basic concept of orthodontics. From this time, according to Dr. Angle, extraction was taboo, and those who resorted to it were adjudged to be guilty of perpetrating a new crime, namely, odontocide.

At the close of the 1911 session of the Angle School, Dr. Albin Oppenheim reported for the first time the results of his investigation of tissue changes incident to tooth movement. This was, perhaps, the first piece of organized research directly related to orthodontics. Its effect was immediate and profound. Dr. Oppenheim had disproved the two diametrically opposed theories of tissue changes contained in Angle's seventh edition. No one questioned his conclusions, nor did anyone for a number of years repeat his experiments.

Oppenheim's findings gave birth to a new orthodontic creed, that of gentle force and slow movement. Together with the philosophy of the full complement of teeth, this creed was the instrument that at last firmly established the science of orthodontics on a biologic foundation.

As an aftermath of Oppenheim's presentation, we neophyte orthodontists were initiated into the mysteries of a new appliance which was going to revolutionize orthodontic treatment. It was called "the pin and tube appliance," and was heralded as the "bone growing appliance," or the "working retainer." Oppenheim had shown that bone grew in response to pressure, and this appliance was said to produce just the right kind of pressure to make bone grow. What a letdown we experienced after we tried to make bone grow with this appliance! We were told always to keep the famous Huning case in mind, for this case not only proved the rationale of the full complement of teeth but also proved beyond a doubt that we as orthodontists could actually make bone grow.

In 1911, however, all was serene on the orthodontic horizon. A challenge had been thrown out to the profession, and we young orthodontists were sent out into the world with Dr. Angle's blessing and were told to meet that challenge at all costs.

But the orthodontic horizon did not long remain serene. Some men began to question the events of yesteryear. Dr. Milo Hellman was probably the first to apply scientific standards to some of Dr. Angle's theories. First attacking the *status quo* of occlusion, he applied facts to the ideal scheme and found that it must be modified. His conclusions[6] were a most important step in the evolution of orthodontics.

Later, Dr. Oppenheim's findings and their application to orthodontic therapy were questioned. Dr. A. LeRoy Johnson, who published a series of profound philosophical lectures entitled "Basic Principles of Orthodontia,"[8] quoted such men as Murk Jansen, Solger, Dahr, and others as protesting the verification of Wolff's law of bone formation, the law that formed the basis of Oppenheim's interpretation of his data.

Gottlieb[5] recently repeated Oppenheim's experiments and came to entirely different conclusions. He found that the amount of severity of pressure made

no difference in tooth movement and that the histologic picture was not at all as Oppenheim had presented it. Instead of a reorientation of bone trabeculae on the side of pressure and traction, the tooth first came up against bone, which, for the time being, limited the amount of tooth movement. Further, he found that on the side of traction there was a thickening of the periodontal tissues, with evidence of new bone formation. No bleeding or torn fibers could be found on the side of traction, though on the side of pressure there was evidence of hemorrhage and necrotic material. This material was later shown to have been removed as a result of regenerative processes. As pressure was continued, osteoclasts appeared on the side of pressure in order to remove the contacting bone and free the tooth so that it could move in the direction of pressure. One of the most important findings was that the tooth is always protected by a layer of uncalcified cementum which prevents any damage from overloading.

On the basis of such facts, it appeared that orthodontic treatment per se did not produce ill effects; it was rather the protraction of treatment over many years that was responsible for unfavorable results, and, further, that the shorter the treatment the smaller was the chance that systemic irregularities would interfere with the attainment of the objectives of treatment. Accordingly, the use of stronger forces over a short period of time is justified, and the formula of gentle force and slow movement is refuted. Thus, as evidence changes, our opinions and practices change also.

The other day I read an editorial, "Early Ambulation," reprinted from *The Journal of the International College of Surgeons.* The point of that editorial was that, while early ambulation in surgery had been introduced as early as 1899, it did not then gain acceptance except with a few European surgeons. The revival of early rising and the first generally accepted scientific study of its consequences are attributable to the work of one man, Dr. D. J. Leithauser of Detroit.

It may be worth while to quote a sentence or two from that editorial, for it fits the situation in orthodontics so well that the entire editorial might be paraphrased in orthodontic terms. "Like most investigators with a radical and unconventional idea," the editorial writer stated, "he met with resistance on the part of many of his colleagues when first trying to convince them of its virtues. It is greatly to his credit that his modest and sincere efforts prompted by daring and imagination, led to such a strikingly clear and convincing study of results that the principle has gained widespread interest and many adherents."

In 1935 at a meeting of the American Dental Association in New Orleans, I met such a man as is described in this editorial. His name was Charles Tweed, and he came from Tucson, Arizona. For over six years, he had practiced the philosophy of the full complement of teeth under Dr. Angle's personal guidance. He accepted the challenge that Dr. Angle had thrown out to him. He found, however, that he could not, in all his cases, fulfill the requirements of the "line of occlusion" and still maintain a full complement of teeth.

So, in spite of his great admiration and undying friendship for Dr. Angle, Charles Tweed had the daring and imagination to revive the question of extrac-

tion in orthodontic therapy. He would be the first to admit that his reasons for adopting this rather unconventional procedure were based, at first, more on a clinical hunch than on purely scientific grounds. And he was a clinician par excellence. He became wholly dissatisfied with a method that in some cases resulted in ruining occlusions and faces, and in his determined manner decided to do something about it.

However, Dr. Tweed was not entirely satisfied with the analysis he was able to make of the changes that occurred as the result of his procedures, and he began to search for scientific evidence that would either justify or refute his methods. In this study he had the cooperation of other men, some of whom were working in the field of growth and development, while others were trying out his theories in actual practice.

Tweed's concept of placing the mandibular teeth upright on basal bone is all-important to an understanding of his method. True, this concept originated in prosthodontic practice. Is there anything wrong with that? Tweed had noted that in normal occlusion the mandibular incisors were more or less upright on basal bone. He had observed this to be true in his own successfully treated cases, in Indian skulls, in untreated normal occlusions, and in the successfully treated cases of other practitioners. His hunch or, as I prefer to say, his cephalometric eyes told him that the inclination of the mandibular incisors on their bases ranged from a position of plus five to minus five degrees.

Later, when Margolis[12] made his study of the angulation of the mandibular incisors in relation to the mandibular plane, he found that Tweed was, on the whole, correct in this statement. Upon examining Broadbent and Brodie's[2, 3] cephalometric studies, which, by the way, were not concerned with this angulation, Margolis found a close agreement with Tweed's contention, which was based solely on the clinical evidence he had seen. On the basis of this substantiating research, the application of Tweed's concept to therapy seemed biologically justified. On this principle, therefore, Tweed and his followers began all treatment by placing the mandibular incisors over base and in an upright position, as a foundation for building normal occlusion in accordance with Angle's interpretation of the "line of occlusion."

Here I should like to clear up a point concerning which there has been some misunderstanding; namely, that it was Tweed's belief that there was but one ideal facial type and that, in orthodontic therapy, all faces must be made to conform to this type. Though he may have given an erroneous impression in his first paper, Tweed well knew that there are several types of normal faces. The idea he had of the normal face was not a rigid concept but, rather, an image he had in the back of his mind, representing a goal toward which he was striving, an ideal face embodying Dr. Angle's concept of beauty, symmetry, balance, and art. Two sentences from one of Tweed's papers may serve to clarify his meaning: "I maintain that normal occlusion or perfect facial aesthetics can never be attained without the full complement of teeth. But I also maintain that when a discrepancy between tooth pattern and basal bones does exist, it is far better to remove dental units to bring about a balance between tooth anatomy and basal bone; and that if this correction is made, our patients will be benefited by a

nearer approach to the normal than is possible if we retain all the dental units and in so doing are compelled to displace the teeth off the dental ridge and into protrusion."

Hellman[7] described three main types of normal faces occurring with normal occlusion. In all these types, it should be noted, the mandibular teeth occupy a position on basal bone varying from approximately 85° to 95° to a line drawn tangent to the lower border of the mandible. This fact can be proved to one's own satisfaction by arranging a number of nonorthodontic normals in accordance with cephalometric standards. But what about those faces in which the mandibular incisors describe an angle exceeding this normal range, whether the discrepancy is due to growth factors or to orthodontic interference? And what is to be done about the use of the term "bimaxillary protrusion," the term Tweed used, perhaps loosely, to describe the results of orthodontic treatment that moved teeth forward on their bases and into protrusion?

In 1923, Lundström[11] in Sweden and Simon in Germany were thinking and writing in terms of orthodontic limitations. Lundström had written of the apical base problem in relation to bimaxillary crowding, and Simon, attacking the problem of dentition in its relation to skull anatomy, spoke of bimaxillary protractions and retractions. Using gnathostatic methods, Simon described three kinds of bimaxillary protraction or, as we say, bimaxillary protrusion. There were purely dental protractions, alveolar protractions, and maxillary protractions, as well as combinations of any two of these types. Of interest is Simon's definition of a purely maxillary protraction, which he was not sure could be demonstrated, but which, if demonstrated, could not be treated orthodontically with any great degree of success.

However, both Lundström and Simon came to the same conclusion, namely, that certain types of malocclusions were not amenable to successful treatment by what they termed the "Angle method." Recently, Margolis[12] has cleared up the matter, in a measure at least, by distinguishing between bimaxillary protrusion and bimaxillary prognathism. According to him, a bimaxillary protrusion is a condition brought about by incorrect orthodontic treatment whereby the teeth are moved into protrusion or, as it were, protruded, whereas a bimaxillary prognathism is a type of individual in which the lower part of the face, i.e., both jaws, projects beyond the face. A bimaxillary protrusion simulates a prognathism, but only in the region of the mouth. There is no disagreement as to what these conditions represent, but there is some disagreement as to what is to be done about it, especially in the true prognathic types. Tweed, in his studies of the so-called Frankfort-mandibular plane angle, called attention to the different types of protrusion and to the limitations of treatment and prognosis. Tweed's[15, 16] findings require further checking and verification, but his methods are a step in the right direction and will gain in value as the use of cephalometric methods becomes more common among orthodontists.

But while definitions and correct terminology are important if we are to speak the same language, it is even more important for us to examine the evidence made available by various studies in growth and development of the face and to apply such knowledge to therapy, analysis, and prognosis.

Hellman[6] made the first detailed, scientifically acceptable study of the growth and development of the face and its component parts in relation to orthodontic procedure. His account of the course of growth, the stages of development of the dentition, and the variations in these events is standard and has never been surpassed. However, his application of the evidence to practice is open to question, and the practicing orthodontist must still make the final decision about the proper application of these data on the basis of the facts as he sees them.

For instance, let us examine the following statement by Hellman: "The teachings that malocclusion of the teeth is due to arrested development, that arrested development is susceptible to mechanical stimulation, that orthodontic appliances are capable of stimulating growth, and that the treatment of malocclusion of the teeth influences the growth changes of the face cannot be upheld. . . . The development of the face is a natural process and takes place regardless of orthodontic treatment."

Doesn't such a conception spell orthodontic limitation?

Brodie[2, 3] has corroborated certain of Hellman's findings, but has gone a little further in the study of unit problems. In words somewhat different from Hellman's he says: "The most startling finding was an apparent inability to alter anything beyond the alveolar process. The basic pattern was unaltered except for those changes which one might expect from growth."

Now, what do these statements from different men working with different methods mean to us? In my opinion, we can come to only one conclusion, namely, that if we cannot make bone grow and we find that the amount of bone in a given case is insufficient to accommodate all the teeth in their proper relations to their base, we must either harmonize tooth anatomy with bone or depend on natural growth processes to make up the disharmony, and the latter seldom happens. If such growth often occurs, as some would have us believe, why is it that so many of our cases collapse or end in failure, both esthetically and functionally? Can we always hide behind the curtain of variation? It seems doubtful.

In the different approach represented by the anthropometric methods of Hellman and the cephalometric methods of Broadbent, Margolis, and others, we begin to see the advantage of the unit system of study. Todd,[14] in speaking of Broadbent's cephalometric studies at the Bolton Foundation, had this to say: "Broadbent's study analyzes the consequences of disturbed growth, provided we realize[4] that facial dimensions and form represent an achievement influenced not only by the unfolding of hereditary pattern, but also by the temporary inhibitions of ill health and permanent restrictions of deviations from normal endocrine control."

But it is to Schour and Massler[13] that we are indebted for newer knowledge of the effects of temporary inhibitions to normal growth of the facial and dental structures and their implications for orthodontic therapy. Using vital staining methods, they have come to important conclusions that have a direct bearing on orthodontic limitations. First, they have shown by irrefutable evidence that the pattern, number, and size of the teeth are determined by the fifth year of life. Both Brodie and Broadbent have corroborated this finding, though they differ

in their opinions concerning the exact time at which these factors are determined. Schour and Massler made the following pertinent statement: "Experimental and clinical analyses of the effects of endocrine and nutritional factors upon the development of the teeth show that the rate and progress of the formation of enamel and dentin are less affected than the eruption of the teeth or the growth of cranial and facial bones."

What does it all come to? Does it not mean limitation, that discrepancy exists at times between tooth anatomy and bone structure, and that, as Hellman and Brodie have proved, we cannot make good this discrepancy? Does it not mean that if we attempt treatment at all we must consider removing dental units to bring about a compromise and thus benefit the patient? Common sense says that it does. Let us realize this, gentlemen, and act accordingly for the benefit of the children entrusted to our care. Let us not beat around the bush as we have done in the past.

Having made up our minds, on the basis of the facts as we have found them, that removing dental units may be as sound practice in orthodontic therapy as the maintaining of a full complement of teeth, how can we best determine what course to pursue in a given instance? The answer to this question is not as simple as one might suppose, but there is an answer. Perhaps the most useful way to answer is to tell you how I myself go about deciding what to do in a given case.

ORTHODONTIC CASE PROCEDURE

First of all, no advice about a case is given to the parents unless they are willing to have complete records made. These records are: Good and accurate plaster models of the teeth; an oriented profile photograph of the face; a cephalometric roentgenogram made on 8 by 10 film; roentgenograms of the teeth, on small films for the anterior teeth and on 5 by 7 films for the posterior teeth; a record of the genetic pattern of the parent's teeth, jaws, and face, if possible; and a good health history. If the history as the parent gives it is not satisfactory, a written report from the family physician is requested, with special emphasis paid to allergies and any endocrine imbalance that may have occurred.

If the patient is in the mixed denture stage, no mechanical treatment is advised unless he has a Class III or an aggravated Class II, Division 1 case, with the upper incisors protruding to such an extent that almost any blow on them would cause a fracture. Except in such circumstances, the patient is placed under observation, and at stated intervals new records and a developmental diagnosis are made.

In Strang's[17] paper, he brought out two very important points:

1. The plan of treatment must aim to preserve those conditions in the deformed denture that simulate the normal, i.e., the balance and harmony of abnormal environmental structures and essential support of undergrown osseous bases.

2. It must take into consideration the elimination of those conditions that are abnormal, such as incorrect inclined plane adjustment, faulty axial positioning of individual teeth, tooth rotations, and excessive overbites.

After the records have been assessed, a memorandum of the results is recorded on a card. This memorandum includes the state of the occlusion, the stage of the eruption of the teeth, any variations that exist, the roentgenographic records in which the Frankfort mandibular plane angle, the mandibular-incisal angle, and the nasion menton are measured, and the photographic profile.

If the case is to be treated, and all the premolars, cuspids, and first permanent molars are erupted, a set-up is made in accordance with the method of Dr. H. D. Kesling. Some orthodontists may criticize as unscientific this method of predetermining the arch form and occlusal pattern, but in my opinion this contribution of Kesling's is one of the most valuable adjuncts to the orthodontist's analytical armamentarium. Used with the records, it can be valuable in determining whether or not to remove dental units in treatment.

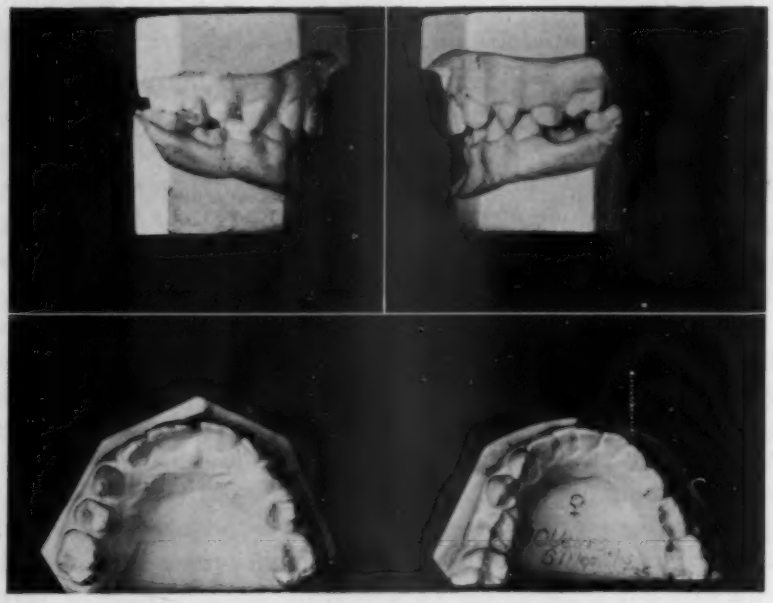
It is fairly well agreed among most men that lengthening or expanding the dental arch in order to gain room for the teeth or correct axial positions in the arch is not good practice. The arch will afterward relapse to its original form, or nearly so. By first setting up the teeth anterior to the first permanent molars, and without disturbing these molars, one can readily see whether or not the incisors must be moved forward or the cuspid region must be expanded in order to gain alignment and occlusion. When the mandibular incisal angle has been determined, one can readily decide whether these teeth should be maintained at the original angle or moved within the normal range of variation. If it is necessary to move the mandibular incisors forward, or if, in order to move them back, it becomes necessary to expand the lateral segment of the arch, the removal of dental units should be considered. If occlusion and arch form can be gained without such measures, then the full complement of teeth can be maintained.

It sounds simple and it is once the technique has been mastered. Furthermore, this set-up method will in a measure tell you when you should and when you should not move the posterior teeth forward, which in turn will help you to determine what anchorage problems you have.

Naturally, as the set-up is made the face form is studied, both from the photograph and from the cephalometric headplate, to see whether or not the dentofacial area will be improved or maintained in treatment. If the Frankfort-mandibular plane angle is a bad one, and especially if it is over 35°, regardless of the mandibular incisal angle, not much can be promised in the way of esthetic benefit from treatment. If the Frankfort-mandibular angle is over 40° and there is a short ramus—you have all seen such cases—orthodontic treatment is not recommended.

When the set-up has been made and you have determined by the assessment of other records what course to pursue, you are ready to use the appliance of your choice. While there are many methods of making an arch form, especially if one uses any of the labial type appliances, the set-up acts as a guide to the final arch form to be used. It is not the purpose of this paper to go into the details of treatment. The treatment of a case in which dental units are removed will be discussed in detail in a subsequent paper.

And now, to let you decide for yourself whether or not the practice of both philosophies of treatment—the maintenance of the full complement of teeth and the extraction of some units when that becomes desirable—is justifiable, several



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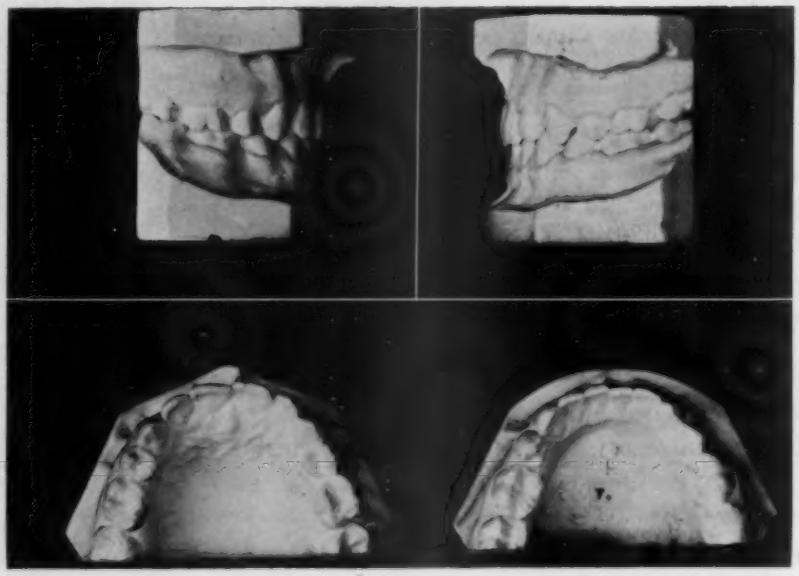


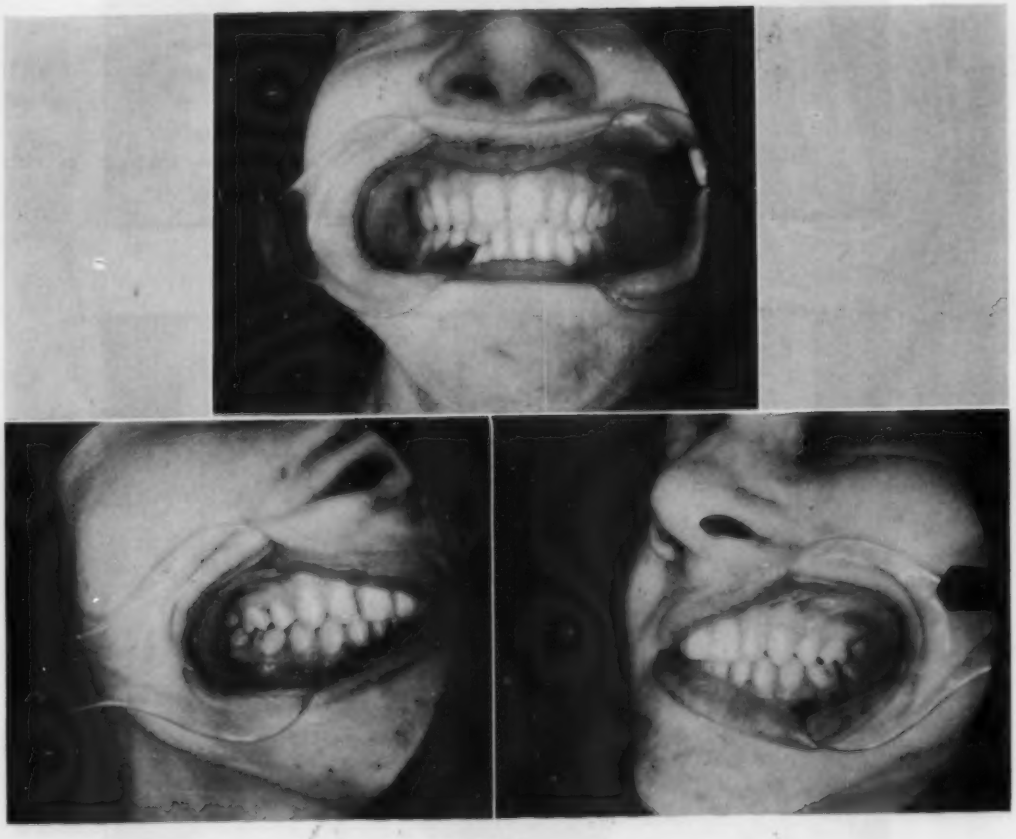
B.

Fig. 1.—*A* and *B*. Case 1.

cases illustrating the two types are shown. In the greater number, dental units have been removed. You may judge whether or not occlusion has been improved, facial esthetics maintained or improved, and the stability of the denture

maintained in these cases. You will observe some relapses in the mandibular incisor region. These relapses, however, are not considered to constitute a failure by followers of the Tweed philosophy of treatment.

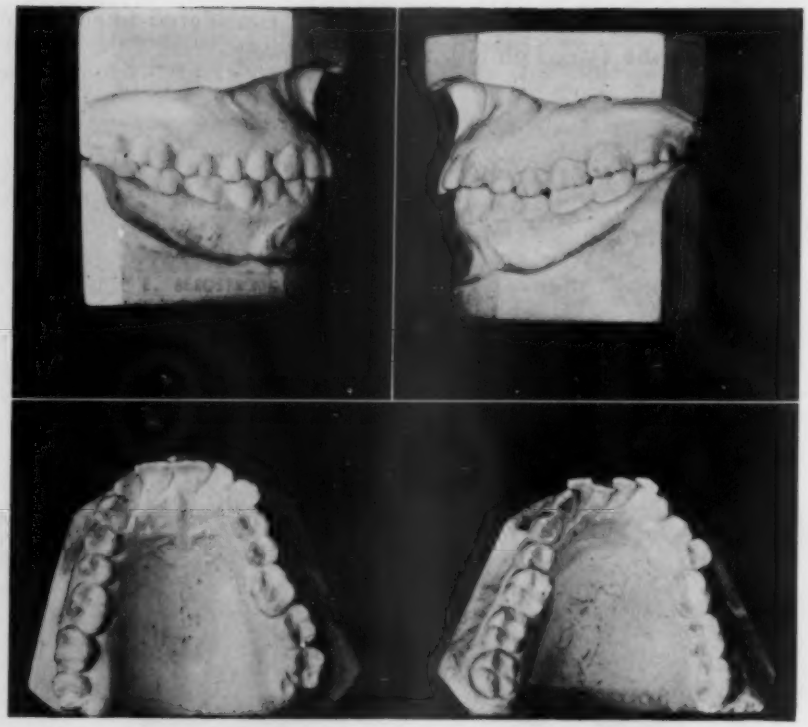
C.



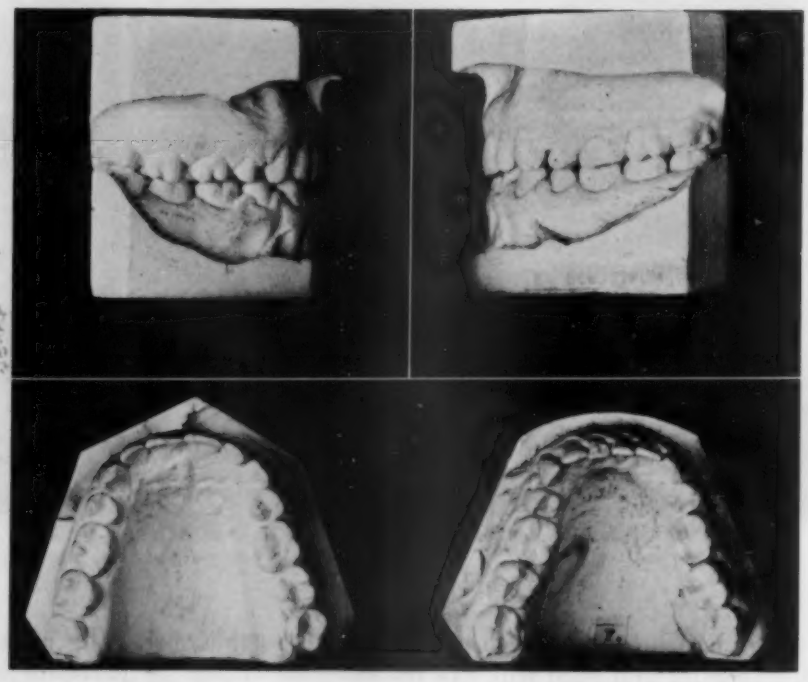
D.

Fig. 1.—*C* and *D*. Case 1.

Finally, I wish to urge upon members of the orthodontic profession the need for greater comity and good will. In the spirit of "Come let us reason together," we should be able and willing to meet and discuss our differences of rationale



A.

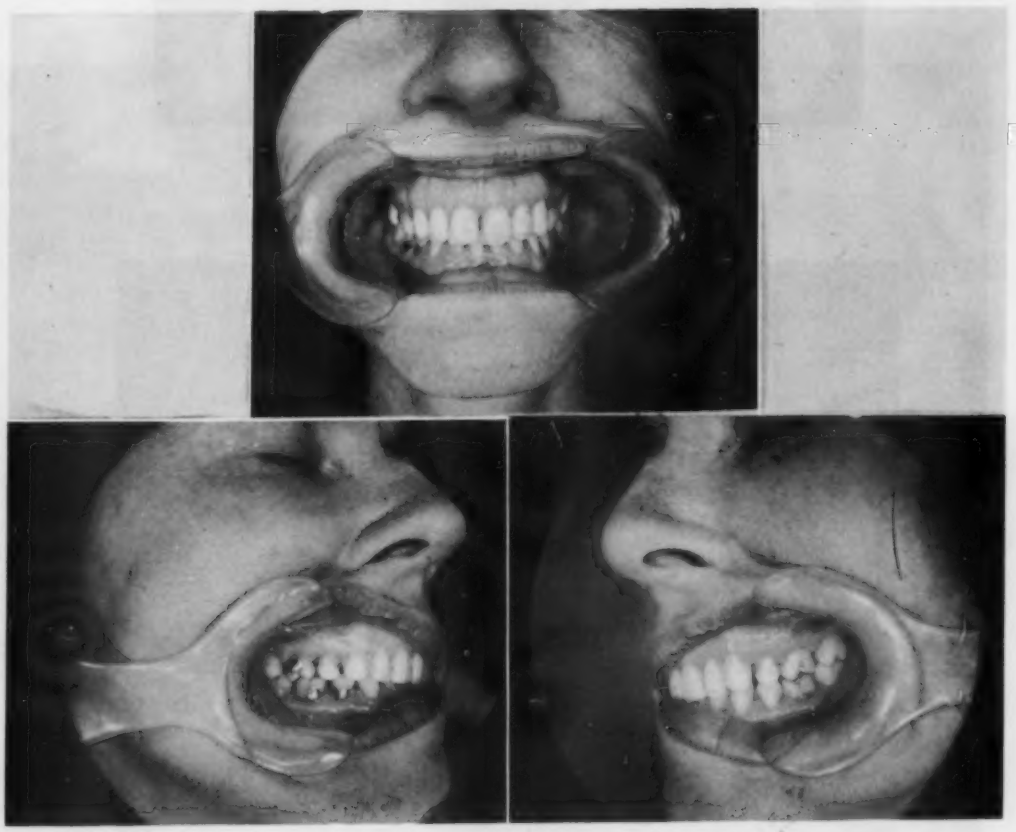


B.

Fig. 2.—*A* and *B*. Case 2.

and treatment for the greater benefit of all. There is good in all methods and philosophies if we are prepared to see it. Let us by all means discuss our differences in a spirit of friendly hostility and with a receptive and open-minded attitude.

C.

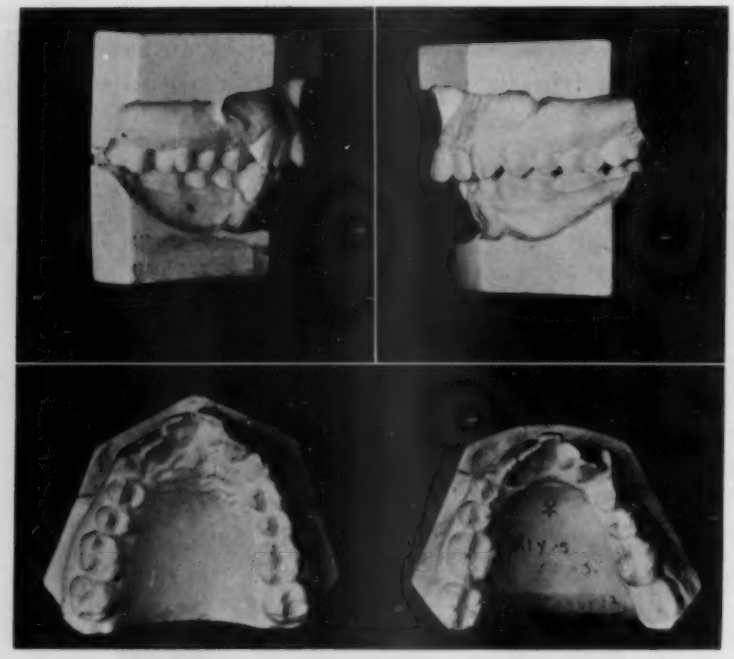


D.

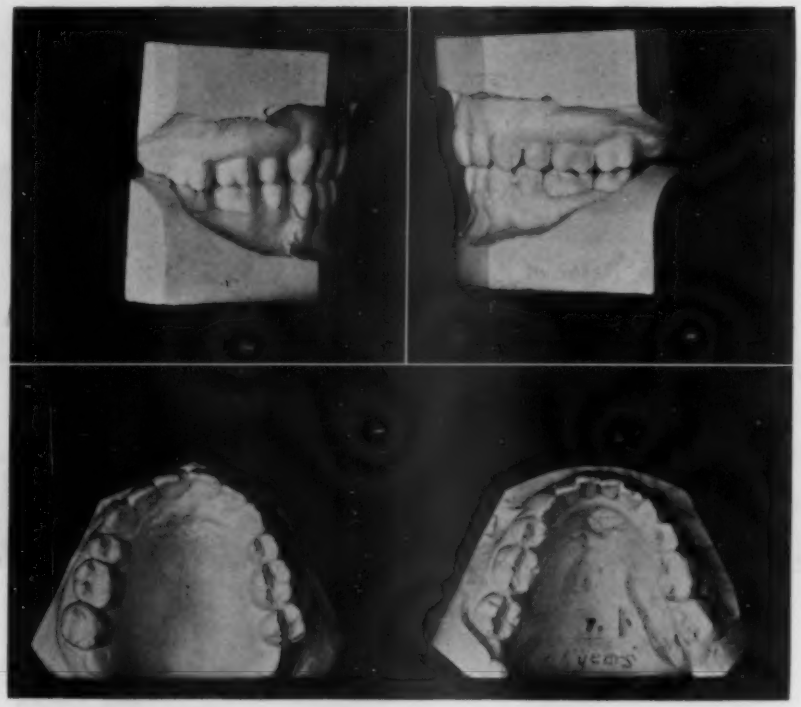
Fig. 2.—*C* and *D*. Case 2.

CASE REPORTS

The eight cases herein reported were the first of a group of twenty patients who were called in January, 1947, and who had been out of retention from eight months to eight years. All were treated with the edgewise arch mechanism



A.



B.

Fig. 3.—*A* and *B*. Case 3.

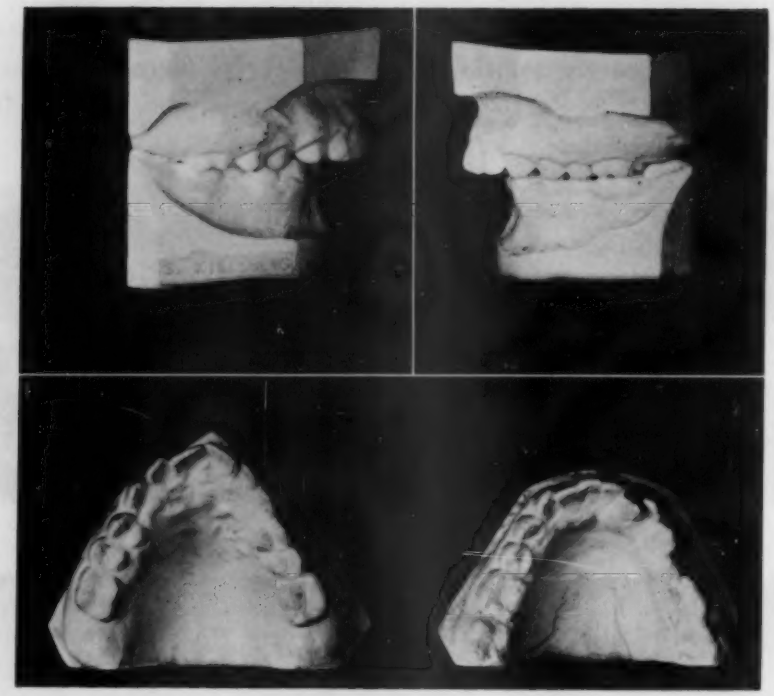
in accordance with the philosophy and technique of Dr. Charles H. Tweed. All but the first two cases have worn the Kesling tooth positioner for varying periods of a month to six months. The intraoral photographs in each case represent the occlusion as it existed in February, 1947, and after all forms of retention had been discarded.

C.

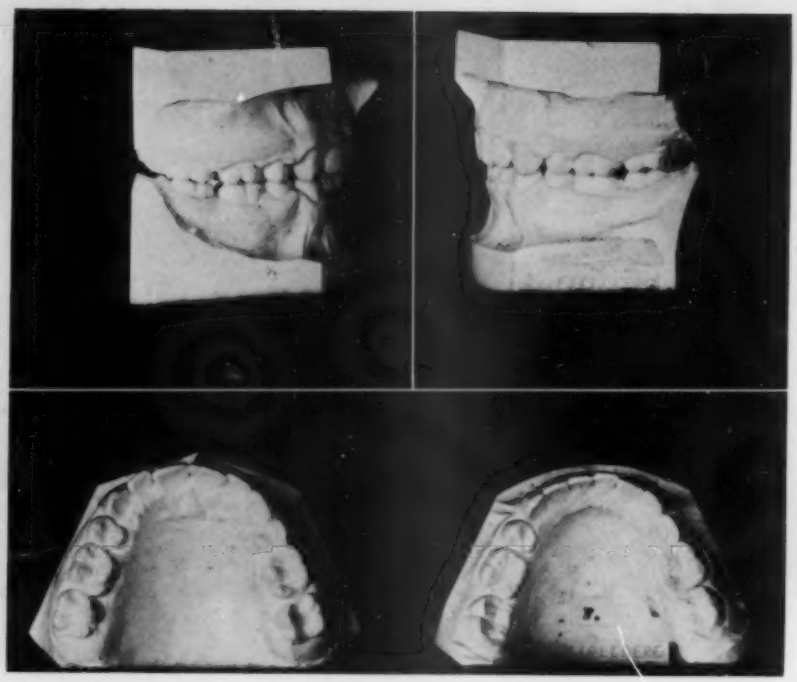
D.

Fig. 3.—*C* and *D*. Case 3.

In the illustrations, *A* shows the sagittal and occlusal aspects before treatment was instituted, while *B* shows the same aspects after the correction was made. The facial profiles (*C*) show the original photographs and the ones



A.

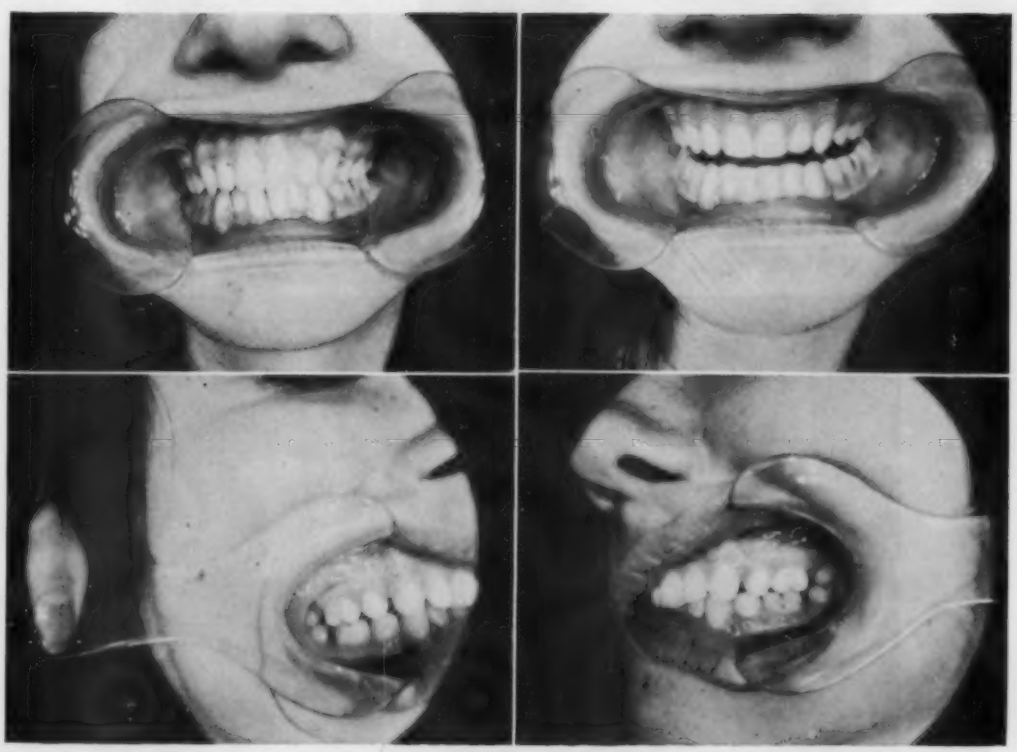


B.

Fig. 4.—*A* and *B*. Case 4.

taken immediately after the appliances were removed. When three photographs are shown, the one to the extreme right represents the face after all retention had been discarded. The intraoral photographs (*D*), represent the occlusal condition after all retention had been discarded.

C.

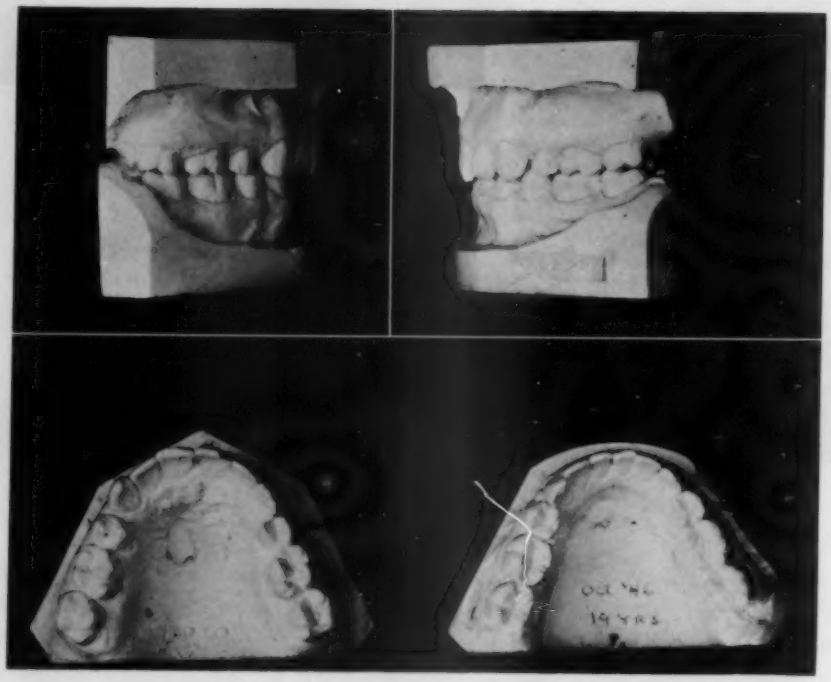


D.

Fig. 4.—*C* and *D*. Case 4.

Case 1.—A Class I malocclusion with a deep anterior overbite, unerupted maxillary second premolars, and congenitally absent mandibular second premolars with retained second deciduous molars. The maxillary second premolars were removed surgically, and the mandibular second deciduous molars were extracted. The case has been out of retention for eight years. Occlusion is stable, and the appearance of the face, though changed but little, is very pleasing. Intraoral photographs were taken in February, 1947.

A.

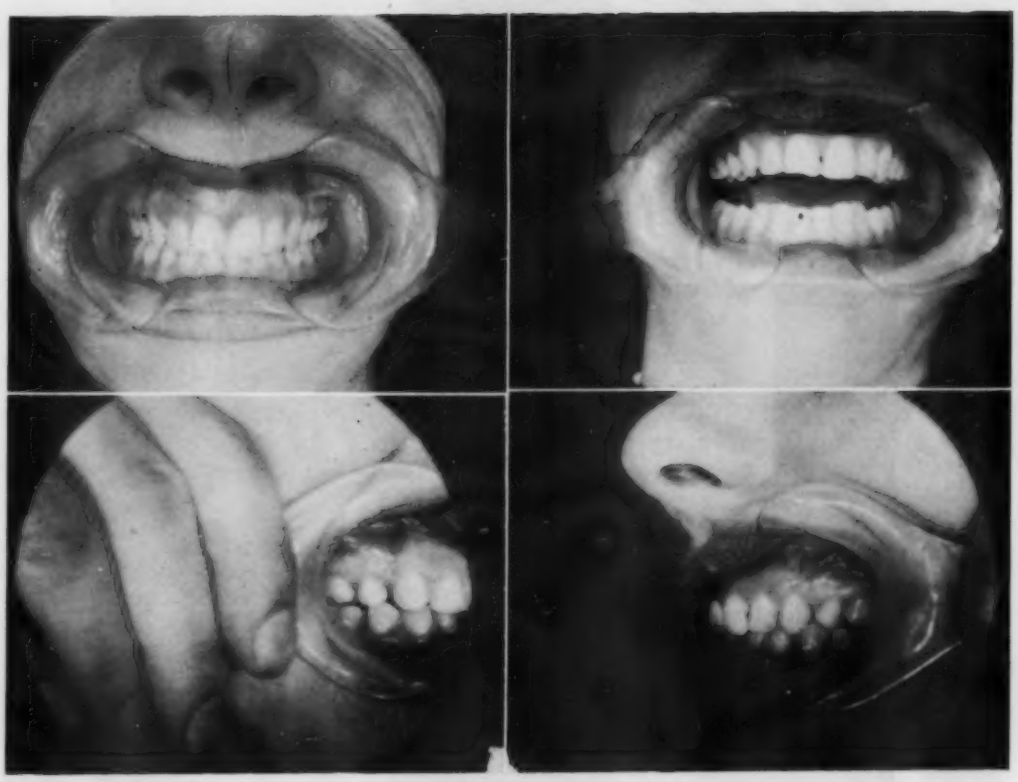


B.

Fig. 5.—*A* and *B*. Case 5.

CASE 2.—A Class I malocclusion with a double protrusion in a girl 22 years old. Four first premolars were extracted. She has been out of retention for two years. The occlusion is stable, but the left side is somewhat in end-to-end occlusion. There is little improvement in the facial lines, but this was not expected as her Frankfort-mandibular angle was 42°. The intraoral photographs were made in February, 1947.

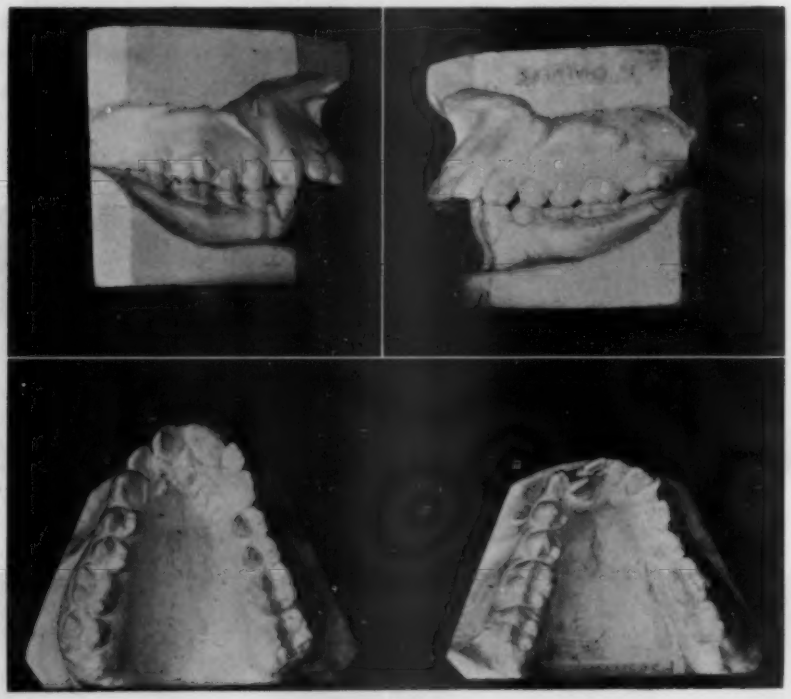
C.



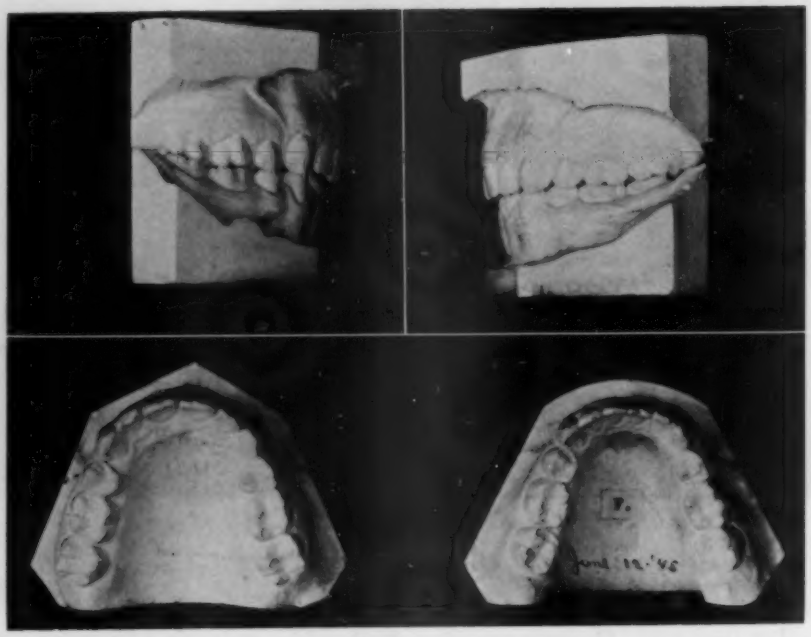
D.

Fig. 5.—*C* and *D*. Case 5.

CASE 3.—A Class I malocclusion with a double protrusion and irregular mandibular incisors. Gums were in a deplorable state, and there was a marked recession on the mandibular left central incisor. The case has been out of retention for fifteen months. The facial profile taken when the appliances were



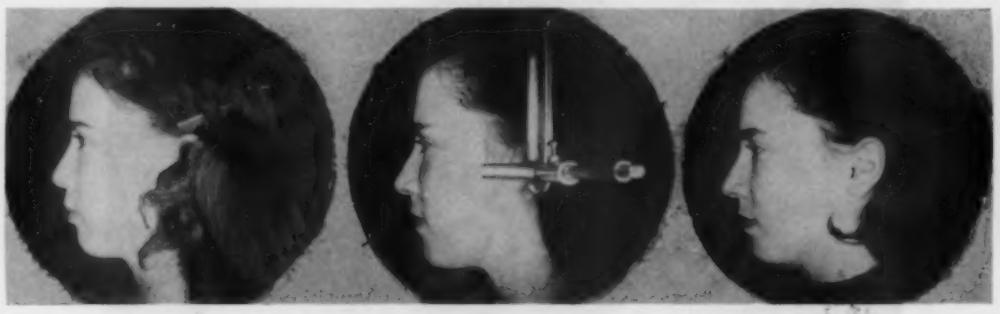
A.



B.

Fig. 6.—*A* and *B*. Case 6.

removed shows a rather dished-in condition. The last photograph, taken at the time the intraoral photographs were made, shows this to have disappeared. Intraoral photographs were taken in February, 1947. There is a slight relapse in the mandibular incisor region, but the occlusion is stable. The gum condition has all cleared up, and there is no evidence of gum recession on the central incisor.

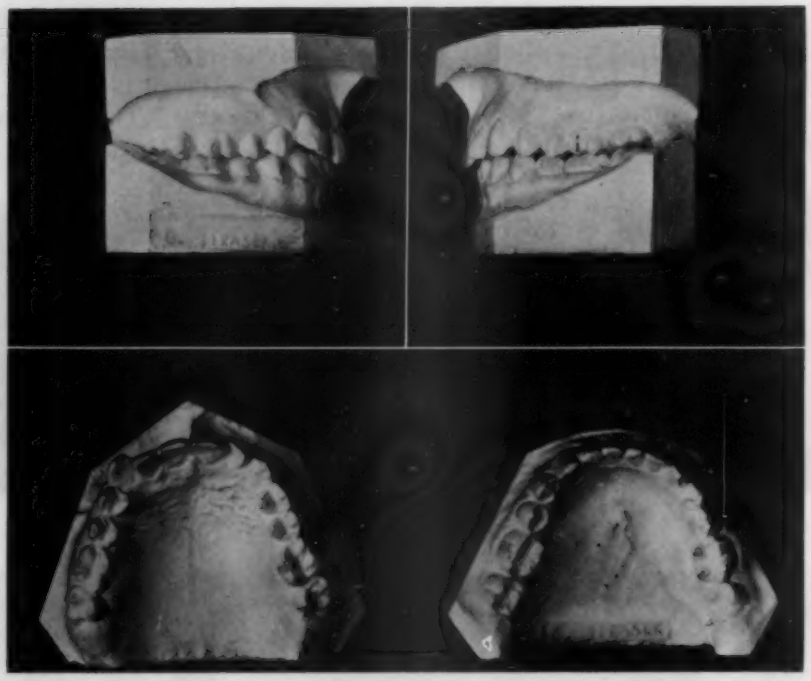


C.

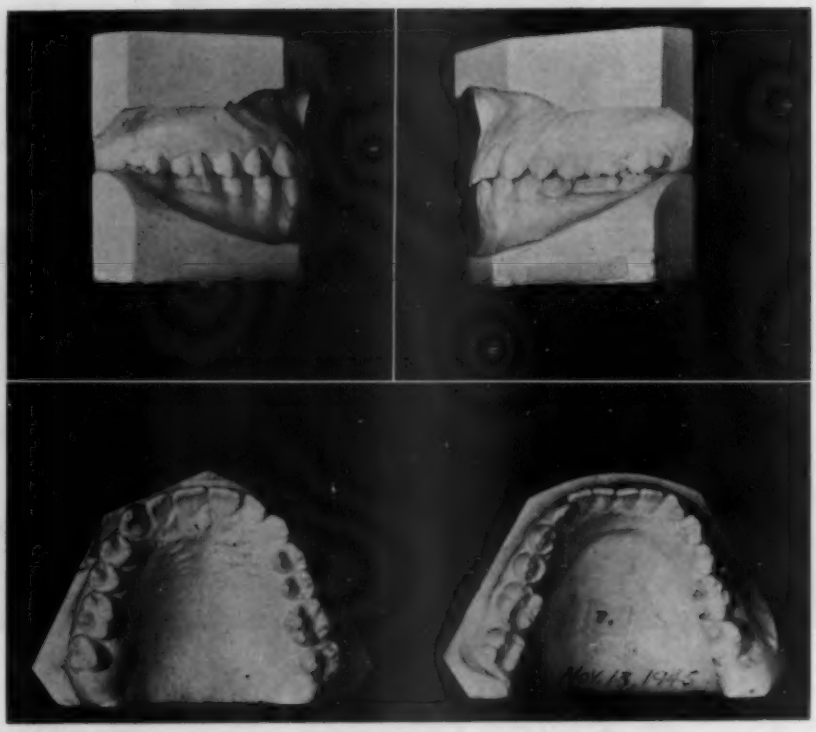
D.

Fig. 6.—*C* and *D*. Case 6.

Case 4.—A Class II, Division 1 malocclusion with irregular maxillary and mandibular incisors. Four first premolars were removed. There was a great deal of difficulty in correcting the mesiodistal relation of the dental arches, as shown in the models (*B*). A tooth positioner was worn for six months, and the



A.



B.

Fig. 7.—*A* and *B*. Case 7.

intraoral photographs show a decided improvement of the arch and tooth relations. The case has been out of retention for two years, and the occlusion is stable. Note that the mandibular right lateral incisor has relapsed somewhat, and that the occlusion is better on the left side than on the right. The facial profile has been greatly improved.

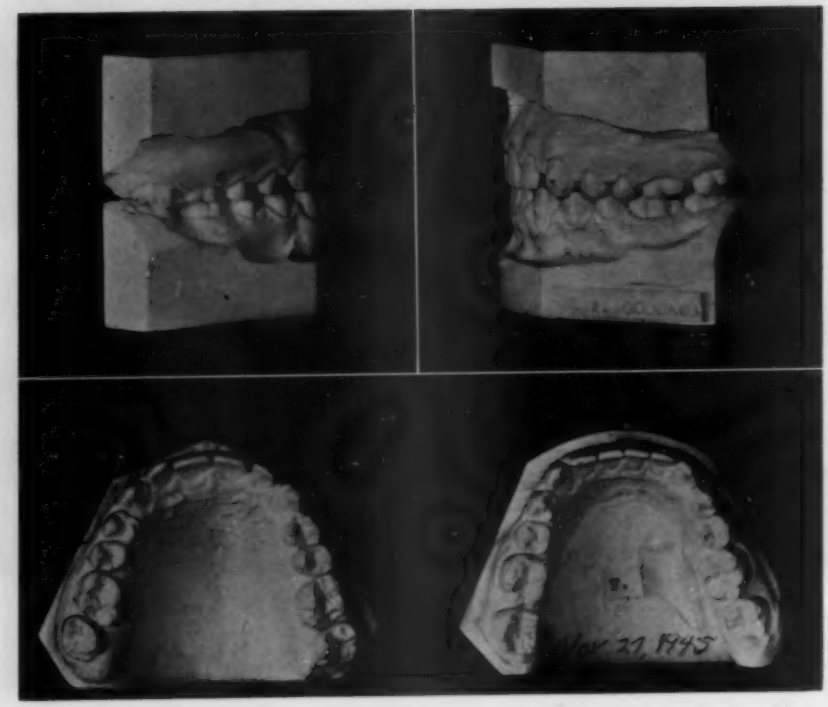
C.

D.

Fig. 7.—*C* and *D*. Case 7.

Case 5.—A Class II, Division 1 subdivision malocclusion, with irregular incisors. Four first premolars were removed. The facial profile was not changed perceptibly at the time the appliances were removed, but the third

A.



B.

Fig. 8.—*A* and *B*. Case 8.

photograph taken at the time the intraoral photographs were made shows a decided improvement. The tooth positioner was worn for two months, after which she went away to college. She discarded this and wore no other form of retention. Two and one-half years later she was seen, at which time the intraoral photographs were made. The occlusion is stable.

C.

D.

Fig. 8.—*C* and *D*. Case 8.

Case 6.—A Class I malocclusion with a double protrusion and irregular incisors. Four first premolars were removed. The Frankfort-mandibular angle was 22°, which is favorable for esthetic improvement of the face. A Kesling tooth positioner was worn for six months, after which a lower acrylic plate was placed for six months. The case has been out of retention for eighteen

months. The facial profile shows a decided improvement. The photograph shown at the extreme right was made at the time the intraoral photographs were taken, and shows that the entire dentition has moved slightly forward. However, the appearance of the face is pleasing. The intraoral photographs were made in February, 1947. The occlusion is stable.

CASE 7.—A Class I malocclusion with a forward drift of the right lateral segment. The lower arch form was good, and a preliminary set-up in accordance with Kesling's predetermined arch form showed that removal of dental units was contraindicated. Active treatment covered a period of ten months, after which she wore a tooth positioner for two months. The facial profile was not changed perceptibly. The patient has been out of retention for eight months, and the intraoral photographs, made in February, 1947, show the occlusion to be stable. This patient was seen again in October, 1947, and the occlusion was still stable.

CASE 8.—A Class II, Division 1 subdivision malocclusion. The preliminary set-up showed that the removal of dental units was contraindicated. The facial profile shows some improvement, but not markedly so. The case has been out of retention for fourteen months, and the intraoral photographs, taken in February, 1947, show the occlusion to be stable.

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308 DAVID WHITNEY BUILDING.

DETAILS OF MANAGEMENT CONDUCIVE TO BETTER SERVICE AND PATIENT-CLIENTELE RELATIONSHIP

LEONARD P. WAHL, D.D.S., WAUSAU, WIS.

THOUGH pressure of time and daily demands for physical effort, of which you are also familiar and subjected, should discourage acceptance of the cordial invitation to present a paper on details of office management, there are two main reasons which prompted me to comply:

First, of direct concern, the possible need for a pattern of management in our specialty which has proved operative.

Second, a factor which shall be commented upon at the conclusion of this paper by virtue of being more remote, but, I believe, basically fundamental and relatively significant.

I feel that anything offered by a policy pattern which may lend itself to our daily problems, tend to eliminate misunderstandings, reflect pleasant relationships resulting in mutual satisfaction with a higher degree of operative perfection merited your presence at the meeting of the Central Section.

Michelangelo was quoted as saying, "Trifles make perfection but perfection is no trifle." Obviously an elementary as well as fragmentary approach in details is necessary in endeavoring to embrace even a portion of a subject of this nature. To the more experienced, it may be but a review, but to the less experienced, an inspiration and possible solution. Gleanings from contributors among whom are Dr. Robert Strang, Dr. Charles Spahn, Dr. Paul Spencer, Dr. Brooks Bell, Dr. E. R. Swank, Dr. Harry Bull, Dr. George Crane, and others will naturally influence its originality as to its entirety.

It is also apparent, though localities and metropolitan details of quality may vary, that we must always be cognizant that the human nature factor and its record of integrity shall always be the bottleneck to any ideal philosophy.

A question was once asked, "Which is the most important leg of a three-legged chair?" The answer is obvious in that they are mutually necessary. I feel this illustration lends itself to the three indispensable factors concerning orthodontic therapy today.

First: A fundamentally basic and scientific training.

Second: An ability and skill substantially to apply this background.

Third: Management of service on which this paper shall dwell. It is my opinion that in no way should it desecrate the dignity of the specialty, but by subtle and refined application enhance its benefit to society.

Presented at the meeting of the Central Section of the American Association of Orthodontists, Minneapolis, Minn., April 15, 1947.

It was Ching Chow, the Chinese philosopher, who said, "If it is possible to be misunderstood, it shall be so." This is not surprising due to being preoccupied; to subconscious motivation; confusion; the human propensity to project responsibility; and to differences in one's sense of understanding and appreciation.

After this vanguard of explanation, the first concern to a beginning shall be our initial patient contact. Incident, thereto, is our reception or approach. At all time our tone and diction should be moderated and cordial, but to the point. The office identification should be the first detail. Sir and ma'am in conversation bespeak mutual significance. They are complimentary and respectful and the reaction is that the addresser is at attention, alert, and at one's service. This seems so trite to mention, but really it is conspicuous by its absence. Our experience has been that a majority of requests for the doctor can be avoided and much time saved by the receptionist or secretary stating that the doctor is operating and regrets he is not available, but giving her status and willingness to take the message, handle the request personally, or to call back at the earliest feasible moment. To say that the doctor is busy, we feel, is psychologically less complimentary.

There are several details concerning initial reservation arrangements which we endeavor to maintain:

(1) To discourage placing reservation time with family dentist unless patient and parents or guardian are present.
(2) To discourage calling patients relative to an initial appointment.
(3) Not to arrange reservations unless patient has been referred by his family dentist or physician. This, we feel, is conducive to good will and cooperation so necessary for complete harmony in our walfare of the patient.

Our first interview shall be concerned with the problem and to discern whether it is one for observation or one for immediate treatment recommendation. If the former is the case, the history card bears all counsel details, and the time when the patient is to be re-examined, followed by a brief report to the family dentist. If active treatment is in order, we recommend processing details for case analysis, with a case report letter dispatched usually in about two weeks subsequent thereto.

As our volume patient reference territory averages a one hundred-mile radius, the initial appointment reservation for these out-of-town patients is ample to allow for history details, patient observation and study as to status of musculature, other etiological factors, and observation of tooth relationship, especially the mandibular incisor units to the underlying body of the mandible. The Frankfort-mandibular degree angle is also discerned. Photographs and impressions for record and study models are taken. If x-ray series are not available at this time, these are procured as soon as possible, lending themselves to the family dentist for diagnosis in ascertaining the operative needs, to be followed by our consideration.

When these details are completed and available, mature study consideration is made, a process which is often termed a case analysis to substantiate

or add to any previous deduction. With this completed, the case report letter is in order, and it is our practice to dispatch one to all parents, guardians, or parties responsibly concerned before a case is entrusted to our active treatment care. We have experienced a mutual reward and benefit well worth the time and effort invested in its compilation. There are details to be covered which parents have a right to be informed about. It places on record a reference to factors important and indigenous to successful treatment which otherwise, due to the protracted time of therapy, may become vague or controversial, thereby avoiding as much as humanly possible the need of exercising personal opinions subsequent thereto. We strive to eliminate the details of mystery which are feasibly explanatory relevant to the case.

The content details of this letter have evolved from possible contingency issues of actual experience, and though we have with a degree of success endeavored to limit its verbosity from time to time, omission in full of any part, we have found, lent itself to a point for misunderstanding. Its chronological order of contents is as follows:

Item I (The introduction reviews in brief, factors of previous consultation and study), for example, shall read as follows:

To visualize better the report of Leigh's dentofacial problem and in turn be of value as a comparative album, we are enclosing three photographs. After appraising this denture, we find we are confronted with a pattern wherein the dynamic lines of stress used in mastication and general function are out of balance due to various etiological or causative factors, but in which the teeth, I believe, are to the greatest degree possible in harmony with their bone base and there is a correlation between the various environmental tissues and parts. Though nutritional interference and a damage to the hard and soft tissues prevail with the relationship now showing, we are particularly concerned with its reflection on the face as it veneers itself over the denture, and, in turn, handicaps Leigh's smile, as well as discounts his true personality.

The outline of treatment shall concentrate on reducing or unraveling the present condition to one in which the denture is more normal in appearance and is in better condition to meet the functional demands as well as resist the destructive forces that are still operative.

(Should an extraction issue present, the following commentary is made):

Due to the excessive amount of tooth substance in comparison with the surrounding musculature and the supporting bone base, I am recommending the elimination of tooth material, consisting of four units, namely, the first tooth or premolar immediately back of each canine or so-called eyetooth, this detail to be completed a week or so previous to your appointment with us.

(If this case should be doubtful concerning this issue, the following commentary is made):

Elimination of tooth material shall not be exercised unless after a reasonable process of treatment it is found necessary for the welfare of the case.

Item II (After this primary or active treatment objective has been attained, comment is made on retention.)

A most important part of our treatment, wherein by semifixed or removable devices we guard our correction, but allow each tooth to function with as much freedom as possible, permitting thereby those living forces which make our problem one of biologic as well as mechanical concern better prepared to take over its maintenance. Of the living

factors previously referred to, we are particularly concerned with the quality of bone and musculature, the latter being an active and destructive dynamic detail in the problem. Because in many cases there is a limited control of these factors from the orthodontist's standpoint, it shall be necessary as an intelligent deduction to place our final functional stabilization point at about 90 per cent. We shall, however, make effort to hold our treatment result at its highest.

Item III (Concerns the assemblage of mechanism and appointment reservations) reads as follows:

Our first step shall be the assemblage of the mechanism, with appointments for inspection and adjustment on the average of every three weeks subsequent thereto, unless breakage of parts demands emergency care. Time from school schedule must be taken due to necessity, as it is unfeasible to do otherwise. Because of its health significance and infrequency of sittings, this has not been found difficult to comply with when cooperating with the school faculty.

Item IV (Concerns mouth care.)

The cleaning of the teeth and appliances is important. Though the mechanism in itself protects the teeth, its presence is naturally conducive to the accumulation of food, which must be carefully removed after each meal, particularly from the exposed tooth areas between the gum tissue and the bands. This process of careful cleaning should be done before the mirror with ample light so that inspection is possible. Your final check, as parents, at least once a day is recommended. Instructive demonstrations shall be given as to the correct method of getting results, for, obviously, the intervals between sittings will not allow me to do more than remind one of any failure in this respect, and of the damage which may result. The importance of seeing your family dentist during your period of treatment should be recognized regardless of this service. Unless he advises otherwise, my suggestion is that this be not less than every four to six months. Should there be no operative needs, I feel he should be informed as to the progress of the case.

Item V (Concerns details considered home responsibilities outside our province, but essential to success in treatment.)

The keeping of appointments should be subservient only to sickness or absence from the city, and when so caused and arranged for shall in most cases require replacements during school hours if we find time available, and, if not, at your next regular reservation. The eating of proper foods should include on an average one quart of whole milk a day unless allergic reaction demands a substitute, and, in turn, should not include in such foods those that are destructive to the appliance. You should refrain from picking at the mechanism with foreign objects such as pencils, matches, hairpins, or fingers. The wearing of elastics, headcap, and performing of exercises, if necessary, must be dependable. Recreation of too strenuous a nature should be avoided because of the possible damage to the case, necessitating thereby delay in progress and added expense. Proper rest and fresh air are, in a true sense, nutritional factors all of which are closely associated with establishing an improvement in the nervous background of a growing personality which invariably gives vent through the muscles surrounding the denture.

Item VI (Concerns fee considerations and details associated thereto.)

The terms of fee payment which I find lenient to an operative plan are as follows: An initial consideration of $———— is paid at the first sitting for assemblage of the appliance. This item but partially covers the expense concerned with case study, its report, outline of treatment, preparatory bench work, and the necessary time reserved for the tailoring and the assemblage of the mechanism. To lend itself to budgeting, the monthly payments shall be $————. This consideration should not be construed as an item paid for services done at any one particular sitting. During vacations, for instance, one may be absent for a month or more, but the time required for preparation and resuming treatment may be greater than if regular visits had been made. Should the case, for

uncontrollable reasons, be discontinued, payments shall not be in excess of services rendered. Barring delays due to sickness, accidents, or appointment delinquencies, I feel sixteen to twenty months should be available for the active treatment necessary.

Item VII (Retention expense.)

As the retaining devices operative during the retention period become your property, the cost of same not to exceed $————, any repair due to accidental breakage will necessarily involve the expense concerned therewith. During the retention period after all parts of the active mechanism have been removed, the sittings will be from six- to tight-week intervals or more during which the monthly fee shall be discontinued, but a nominal one of $———— shall be incurred to cover each examination arrangement.

Item VIII (Conclusion.)

You are permitted to discontinue treatment any time that you see fit so long as I am thereby released of further responsibility with removal of the mechanism. It would be no more than logical that I, too, reserve the right to discontinue treatment in any case wherein an unreasonable lack of cooperation or delinquency is prevalent, as it concerns the welfare of the patient and fairness to all concerned. We solicit questions not herein touched upon, for a mutual understanding bespeaks a happy experience. We are assuming that all operative needs have been completed and the teeth thoroughly polished when Leigh presents. We remain, subject to your pleasure,

Cordially yours,

———————

This completes the report letter.

A letter to the family dentist is immediately dispatched and simulates the following:

———————

Dear Dr. ————:

The case report of Leigh Bugbee is being mailed today, and we are stressing the importance of your care while under orthodontic treatment. Unless you recommend otherwise, we feel he should be examined not less than every four to six months, which shall keep you informed not only of the operative needs but also of the progress of the case.

We appreciate your remembering this office in references concerning orthodontic problems.

Fraternally yours,

———————

Another letter that is part of our case management correspondence is the one following the corrective period of our therapy, namely, the retention stage. Though its importance was briefly mentioned in the case report letter, after several annoying and unpleasant experiences resultant of inadvertent or careless neglect as to details resultant of verbal instructions only, we now make it a rule to dispatch a letter to the parents or guardian reviewing many factors of concern.

The need for protection of our correction deemed advisable for the case with a freedom of the dental units under direction of functional stress as much as possible should be appreciated. These are: rotations, supraclusion problems, etiological factors still operative against which the corrected denture supported by bone that has undergone changes in response to the tension and pressure placed upon it by the forces of the tooth-moving mechanism. Our case must now be nurtured so that Nature may rebuild supporting bone to enable the teeth better to withstand displacement from the so-called normal activities.

We stress parental vigilance against patient delinquency during this period, for should retaining factors lose control of their mission, the case may require replacement of the active mechanism with a resumption of fee expense.

PLEASE BRING THIS CARD WITH YOU

ON _____ HAS RESERVED TIME

AT———O'CLOCK

DR. LEONARD P. WAHL
ORTHODONTICS
518 First American State Bank Bldg. Wausau, Wis.
HOURS, 9 TO 12, 2 TO 5 PHONE 3686

The above time has been reserved especially for you. If unable to keep appointment please give 24 hours' notice, to enable release of such time, thereby avoiding the expense concerned with reservation failure.

Fig. 1.

WAUSAU PUBLIC SCHOOLS
DENTAL APPOINTMENT CARD

Take This Card to Your Dentist

DAY_____ DATE_____ HOUR_____

The Superintendent of Schools has authorized the excuse of pupils only upon presentation of this card.

The teacher is instructed to dismiss the pupil, who will return this card properly attested after the engagement.

Absence or tardiness will not be charged against the pupil but

ALL SCHOOL WORK MUST BE MADE UP

Arrangements must be made that will conflict as little as possible with recitation periods.

The above appointment has been kept and the patient was dismissed from the office at_____

Signed_____

THE TEACHER WILL PLEASE SEE THAT THE PUPIL LEAVES IN SUCH SEASON THAT THE APPOINTMENT CAN BE MET PROMPTLY.
THIS IS IMPERATIVE.

Fig. 2.

When we feel the denture has been protected a sufficient period to allow the living factors of retention previously mentioned to be more dependable, we shall wean ourselves from its support by leaving the upper retainer out on some Saturday morning for a few hours, testing it at intervals for replacement, gradually reaching a point where it may be left out for the complete day, to be worn at night for three or four months, then followed by every other night, and eventually week ends. The remaining maturation journey of the case is one of the many factors which may modify one's counsel as to these details.

As the device, whether a Harold Kesling's tooth positioner or an acrylic plate is employed, becomes the property of the patient, it involves an expense concerned therewith. Its replacement in case of loss and any accidental breakage will naturally incur the expense involved.

ORTHODONTIC TREATMENT REPORT

This report is rendered for its helpful significance

Name _____

From _____ To _____

Appointments have been ( ) Regular ( ) Irregular

Remarks _____

_____

_____

Mouth Cleanliness: ( ) Good ( ) Fair ( ) Poor

Care of appliance: ( ) Good ( ) Fair ( ) Poor

Broken or lost parts needing replacement: ( ) Bands ( ) Ligatures ( ) Arch Wire

Probable cause of breakage: ( ) Rough play ( ) sticky or hard foods ( ) fingers ( ) pencils, etc. ( ) tongue

Unnecessary breakage means delayed progress, prolonged treatment, and naturally added expense.

Conditions would indicate instructions have not been followed as to: ( ) wearing elastics ( ) headcap ( ) regular examinations by family dentist ( ) exercises concerned with _____

( ) Retaining factors considered necessary as insurance contributions in maintaining and preserving the highest degree of correction.

Progress has been ( ) favorable ( ) good ( ) retarded

Remarks _____

Fee payment status: ( ) As agreed before case was entrusted for treatment ( ) Modified by special arrangement ( ) Months delinquent ( ) Case subject to discontinuance of treatment pursuant to reasons set forth in original case report letter.

Remarks _____

_____

_____

_____

As desired progress bespeaks the highest degree of cooperation in the above details of patient and parents' responsibility, may I suggest periodic review of case analysis report for the help it will lend in renewing their significance.

_____

Fig. 3.

It is important that the retainer be placed in the container issued as a protective measure whenever it is removed at mealtime or when allowed out of the mouth.

The case shall be considered in active treatment until all lower bands have been removed and the lower retainer placed. We then inquire if there are any questions and ask that the patient feel free to contact us.

There are several other pieces of correspondence of great significance which we sincerely make it a rule to recognize:

1. To acknowledge gratefully a case referred by another orthodontist.
2. To report details of service concerning a patient of another orthodontist.
3. One concerning your own case reference with necessary information and records.

The fee arrangement on orthodontic service is based on the most lenient terms we have found possible for your case. The regularity of this detail is obvious not only for the contracted time set aside for sittings concerned with inspection, adjustment, and counsel but the bench preparation between appointments required by outline of treatment, and emergency needs from time to time taken from otherwise productive income.

With these factors brought to your attention, we feel you will realize the need for complying with the schedule of payments as set forth and agreed upon in your original case report letter.

Fig. 4.

WAUSAU, WIS. _____ 194__ NO. _____

DUE _____

_____ AFTER DATE FOR VALUE RECEIVED _____

PROMISE TO PAY TO THE ORDER OF DR. LEONARD P. WAHL
615 FIRST AMERICAN STATE BANK BUILDING

AT HIS OFFICE OR AT THE First American State Bank WAUSAU, WIS.

_____ DOLLARS, $ _____

WITH INTEREST AT THE RATE OF _____ PER CENT. PER ANNUM, FROM DATE UNTIL DUE, AND TEN PER CENT. THEREAFTER UNTIL PAID WITH EXCHANGE, COLLECTION CHARGES AND ATTORNEY'S FEES, SHOULD SUCH EXPENSE BE NECESSARY IN COLLECTING.

ADDRESS _____ _____

_____ _____

Fig. 5.

There are also five printed forms which we find definite need for:

1. The regular reservation or appointment card (Fig. 1).
2. The official school excuse (Fig. 2).
3. The report card (Fig. 3).
4. The fee delinquency commentary (Fig. 4).
5. The note form (Fig. 5).

These shall be projected on the screen for your inspection. Though the report card may be changed to meet various needs, it has been helpful to us in attaining results.

CONCLUSION

The second factor which prompted the presentation of this paper and which was mentioned in the introduction as being somewhat remote but relatively significant is as follows:

When we are confronted with many philosophies concerning the economy of living, many of which evade facts, prevent normal adjustments, cheapen monetary value, nurture us against the realities of life and, last but not least significant, destroy the possible grace of human and social relationship, one is indeed impressed with the lack of being informed by many of us in the elementary training, understanding, and application of economic principles. One's reaction to such judgment and behavior by those in what should be exemplary key positions should lead us to recognize the danger of these responsible assignments being occupied by unqualified personalities.

A salient example of the need of more horse sense with economic management is to experience universal strikes when production is low; the objective is diametrically opposite to factual possibilities.

This would lead one to deduce that more true and basic philosophy should be stressed in our system of training as far down the line as the ability to reason formally presents. We must be informed that our standard of living is based upon our ability to meet the necessary responsibilities concerned with its attainment and this, in turn, is commensurate to our qualifications in selling our services or a commodity to society, which all sifts down to a plain case of arithmetic. It is an individual challenge which should be stressed as a patriotic, moral, and Christian duty. Responsibility has its natural reward irrelevant of the material gain, a peace of mind and heart which is but a physiologic repercussion which comes from doing our duty to the best of our ability. On the other hand, we must realize that any benefit or privilege from vicarious or altruistic sources must, in turn, carry a responsibility to make it constructive and helpful to the recipient and in fairness to society in order to establish a true sense of justice and faith with the least amount of human exploitation.

We must recognize that human existence is influenced by certain fundamental laws which are as operative as the Ten Commandments because they are biologic in nature:

1. The challenge of economic preservation.
2. The law of the survival of the fittest.

To anyone in the competitive field of life, his prevalence is accepted and only by his recognition shall we be able to replace his predatory propensities by cultural refinement.

This does not mean that idealism must be forsaken. We must all be idealistic, but let us at all times realize that to endeavor to promote idealism beyond its operative possibilities is dire in its consequences, as anyone in a nonnurtured field of endeavor is made to recognize.

Personally, I feel that good management shall hurt no one in an honest endeavor. I believe it is a vital factor indigenous to Christianity with its

cultural influence, conducive to a compatibility and grace in human relationship, and, eventually, a peace on earth. *Why* and *How?* Because to do otherwise evolves penalty factors which are constantly stirring up the power politics of humanity which, in endeavoring to evade the dire penalties resultant of a line of least resistance in management, project the responsibility by promoting *war*.

In closing, may I again stress, "Have faith in human nature to the fullest of its credit, but also realize that the limit of its dependability is the bottleneck to any noble philosophy."

Let us, therefore, be exemplary in our management, for this shall bespeak a fairness to our patients, our contemporaries and associates, our families, and ourselves. Commensurate with one's status in this detail is our basic component of all organized social superstructure, the community affected, with cultural qualities and affluence thus enabling us to be the greatest altruistic nation in the world.

SUITE 518, FIRST AMERICAN STATE BANK BUILDING.

THE ORTHODONTIC PROGRAM OF THE MICHIGAN STATE DEPARTMENT OF HEALTH WITH A NEW CLASSIFICATION OF OCCLUSION FOR SURVEY PURPOSES

GEORGE R. MOORE, D.D.S., M.S., ANN ARBOR, MICH.

IF THE subject assigned to me had been "Orthodontics Today and Tomorrow," you might have expected a more exhaustive discussion of the way in which orthodontic practice will eventually be affected by social forces which are so evident at the present time.

I hold no claim to being a prophet, but I have been in orthodontic practice long enough to see it change steadily along with all dentistry. As Philip E. Blackerby[1] put it, "Society has been moving along at a rapid pace; the normal rate of change has been accelerated first by depression and then by war. Government has taken on new meaning and centralization of power has become the keynote; social consciousness has increased at an amazing rate among the American people and social security has almost replaced the weather as a favorite topic of conversation. Unlike Mark Twain's version of the weather, however, everybody talks about social security, and somebody does something about it."

Orthodontics has for too many years been classed in the luxury level of dental service for us to feel that we will as a profession be quickly drawn into government health programs. However, that there will be government programs including dentistry is a probability practically assured. Year after year attempts have been made to put through various versions of the Wagner-Murray-Dingell bills. To date, fortunately, none of these have been passed, but there is bound to be "a steady barrage of similar bills until eventually a national health program will become a reality instead of just a topic for conversation and debate."

As Dr. Harold Oppice,[2] trustee of the American Dental Association, said in the May, 1946, issue of the *Journal of the American Dental Association*, "The complete story of efforts to render a comprehensive medical and dental service for the citizens of this country will eventually be written in terms of legislation. It is everyone's job to guide this legislation so that in the end it will be productive and successful."

I indicated previously that by tradition orthodontics is regarded as a luxury type of service. In fact, I was told in 1944 by a well-informed and influential advisor of the Council on Dental Health of the American Dental Association that there should definitely be no attempt made to fit orthodontics into a public

Presented at the meeting of the Central Section of the American Association of Orthodontists, Minneapolis, Minn., April 14, 1947.

health program. Yet, I was told by this same man not two weeks ago that if orthodontics is omitted from the present efforts to render dental care to children on a national basis, it will be a sad catastrophe. This man has been opposed to all four of the Wagner bills, but, like Oppice and Blackerby, and hundreds of others who have studied the problem, he feels sure that a national program is coming, and he has in the last two years become educated to the fact that orthodontics, like other phases of dentistry, is capable of rendering true health service that will come to be regarded by the public as essential.

It is true that as orthodontists we may be obliged to discipline our thinking to a certain extent and separate the necessary services from those which are desirable though unnecessary. We are in the habit of examining mouths with our attention focused on maximum service with the objective being actual or approximate perfection of the dentition and not on what a mouth must have done for it to assure continuation or resumption of a state of health. In other words, we have very understandably devoted our attention to maximal rather than minimal service, and, because we haven't needed to do otherwise, it has been easy for us as a profession to rationalize as being necessary everything that we are in the habit of doing for our patients.

A few months ago I was privileged to attend a meeting of the Advisory Committee for the Children's Bureau in Washington. I went there fully mindful of their published expression of interest in doing nothing but a good job wherever they did one in the various fields of maternal and child welfare and crippled children's services, but reading it is not quite like hearing it repeated time after time during a two-day session of the Committee and its various subcommittees. I not only came away fully convinced that they mean to do the best possible for those whom their services touch, but while there I heard repeated expressions of impatience with views or suggestions that were short of this ideal. For this reason, if orthodontics ever reaches a point where its services are solicited in a government health program, the objective may well be the same service we have been accustomed to render.

However, when I was asked by Dr. Fred Wertheimer, Director of the Bureau of Public Health Dentistry of the Michigan Department of Health, to assist in the formulation of a method of occlusal examination for survey purposes, I could not resist the feeling that the examiner in such a survey must have for his use a classification which will give crystal-clear information as to actual needs, at least as he sees them, and that our admitted habit of doing many things that the patient likes when he gets them, but that he himself would not solicit, made the job of arriving at such a classification exceedingly difficult. The situation has been quite different in other fields of dentistry. For example, caries and other infective processes offer no such problem of classification. The line is finely drawn between those children who need service and those who do not need it on the mere basis of presence or absence of the disease, and this knowledge is easily obtained with an extremely high coefficient of agreement among examiners.

Some sort of formula such as the simple formula of presence or absence

dominating the survey of mouths for caries would be desirable in occlusal surveys. Unfortunately, however, there is no such formula and we have little hope that there will ever be one. For this reason, we tried to approximate the presence or absence formula by keeping before us at all times the question, "*Must* something be done for this mouth to restore health or avert ill health?" whenever we surveyed a mouth. If this question could not be answered in the affirmative, in other words, if *might,* rather than must, yielded the affirmative answer, we rated the condition as not needing treatment.

The constitution of the World Health Organization contains the following statement:

"Health is a state of complete physical, mental, and social well-being, and not merely the absence of disease or infirmity."

Lawrence J. Henderson,[3] Harvard biochemist, said, "I should say that the thing which the physician in general, the dentist or medical man or surgeon, has in mind is getting people into a state which is good enough for their purposes, which does not trouble them, so that they can forget about it. I believe that is the proper basis for the practice of medicine."

On first reading, this sounds too general and perhaps a bit trite, but the fact remains that if every citizen under any form of national health program could but realize the enjoyment of health so defined, few would and none could object to their lots. If such a definition applies to general bodily conditions there is no reason to reject it in surveys of occlusion. Moreover, it was our belief that surveys dominated by this thought concerning health and ill health will yield valuable and usable data on actual need for orthodontic service and the time involved in handling it.

It soon became apparent that none of the traditional classifications such as Angle's would yield the desired information as to health needs or time required for correction. We therefore adopted, after considerable study, one that we thought would do so. It is divided into parts A, B, and C (Table I).

A is merely a covering statement with no reference to whether or when treatment is indicated. Its subdivisions are (1) functionally normal, (2) borderline, and (3) abnormal.

B refers to oral habits which in the opinion of the examiner should be broken. No other habits are checked under this heading. Subheading 1 is checked if no habit or only an ineffective one is present. Ten habits are mentioned and Subheading 12 is for other habits regarded as significant in the case at hand.

C is the heading under which we are able to grade cases as to relative diagnostic, clinical, and laboratory time requirements. Subheading 1 is checked if no attention is indicated. Subheadings 2 to 5 refer to present necessities in the way of radiographs, observation, or treatment, and Subheading 6 includes those cases which would best be handled at a later time and would, therefore, not now require more than minimal time for infrequent observation.

Subheading 2 was not used in our surveys because x-ray equipment was available in each of the five locations where surveys were made. Subheading 5 is divided into three parts: *a, b,* and *c.*

TABLE I. CLASSIFICATION OF OCCLUSION FOR SURVEY PURPOSES

A. *Occlusion*, a covering statement with no reference to whether or when treatment is indicated:
   1. Functionally normal
   2. Borderline
   3. Abnormal

B. *Oral habits* which should be broken (none other):
   1. Absent or ineffective if present
   2. Thumb sucking
   3. Finger sucking
   4. Tongue sucking
   5. Cheek sucking
   6. Cheek biting
   7. Upper lip biting
   8. Lower lip biting
   9. Nail biting
   10. Night grinding
   11. Mouth breathing
   12. Other

C. *Indications* (*musts now*, 1 to 5; *musts later*, 6):
   1. No attention indicated
   2. Radiograms (Recheck later; therefore, necessary)
   3. Infrequent observation (six month intervals or greater)
   4. Frequent observation (less than six-month intervals)
   5. Treatment *now:*
      a. Corrective measures requiring complex appliances and extended supervision.
      b. Palliative measures requiring simple appliances for the removal of interferences, and few appointments.
      c. Preventive measures including habit breaking, removal of too long retained primary teeth, trimming of primary teeth; also low-cost preventive or palliative services requiring inexpensive stock appliances for habit breaking and similar treatments; or extraction of indicated permanent teeth.
   6. Treatment *later.*

It will be apparent that this type of classification, based as it is on gradation in time requirements for proper handling of the case, will yield a clearer picture of the true nature of the problem than one based on Angle's classification or any other that is purely descriptive of occlusal relations.

We have no illusions as to the possibility of our figures agreeing with those obtained by orthodontists with slightly different viewpoints as to treatment needs.

We examined a total of 7,373 school children in five Michigan towns, namely, Howell, Ludington, Marshall, St. Joseph, and Sturgis, and found 28.9 per cent of the individuals examined presenting malocclusion (Fig. 1). It is conceivable that someone else examining this same group may arrive at a very different percentage. However, if surveys of this kind can be conducted in all parts of the country and if classifications in detail, whatever they may be, can be drawn up with a view to gradation in time requirements, we will eventually be armed as a profession with data about our own field, painstakingly acquired, on the basis of health service principles that cannot be broken down by agencies foreign to the profession. In view of the social forces so prevalent today, the question is pertinent, "Would we not be making a mistake if we failed to learn these facts about the prevalence and incidence of malocclusion and the over-all time requirements for its treatment?"

It is, of course, understood that the occlusal survey mentioned previously was part of a complete dental survey being made at the same time. While the survey was in progress, it became apparent that in addition to the facts obtained by this method it would be highly desirable to open up a fact-finding dental clinic in one of the communities surveyed. Sturgis was selected by Dr. Wertheimer and his staff for this purpose, since it provided a community which had an organized county health department, but which never had had a dental program, not even a dental health educational program. An additional factor which attracted us to this community for the first fact-finding clinic was the unanimous and wholehearted cooperation of the local dentists, one of whom is the president of the board of education, still another was the fine spirit and material assistance offered by the school staff from Superintendent Paul Winger down.

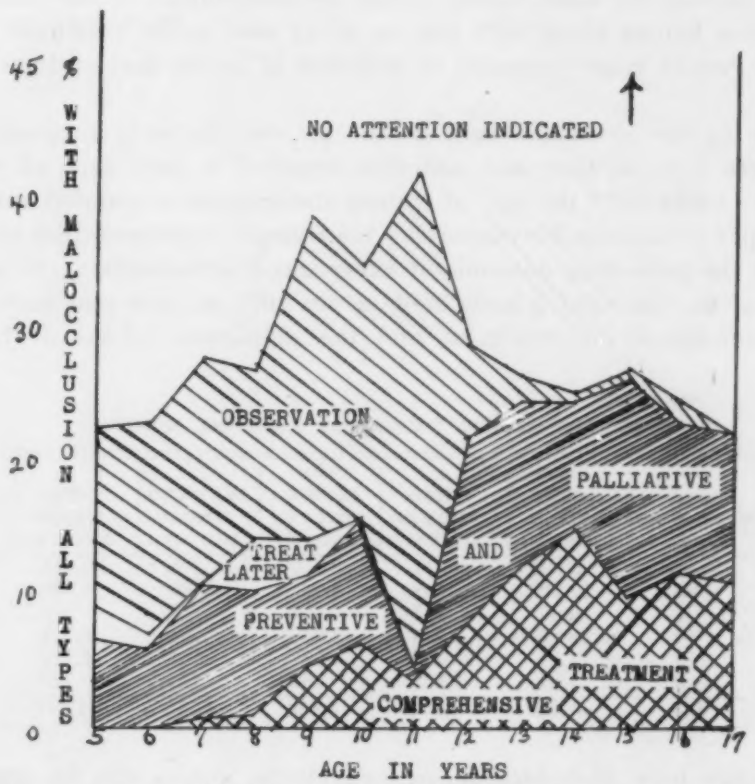

Fig. 1.—Percentages of the various types of malocclusion at all ages from 5 to 17, based on original survey at Sturgis, Michigan.

The school population from kindergarten through the twelfth grade was 1,338 at the time the clinic was opened in the fall of 1945 and the general dental program had progressed for one year before orthodontics came into the picture. In September, 1946, the Michigan Department of Health offered a fellowship in public health orthodontics to a second-year graduate student in our department at the University of Michigan. It was determined that the appointee, Dr. Kenneth C. Marshall, who was present at the meeting where this

paper was presented, would be able to care for the program adequately by spending one day a week at Sturgis. A second-year graduate student will be appointed each year to continue the program, which is planned for at least five years.

As of April 1, 1947, after approximately six months of operation, all indicated work according to the survey had been undertaken for the children from kindergarten through the fifth grade. Six hundred ninety-eight were eligible, and 151, or 21.6 per cent, were classified as needing the service of an orthodontist.

Dr. Marshall brought to the meeting a well-labeled exhibit of fifty cases under treatment or observation at Sturgis. Only a few of the simpler problems of treatment had reached the stage of completion. For this reason, it was too early to arrive at any conclusions on average diagnostic, laboratory, and chair time requirements for cases falling under the subheadings of our classification. He had these figures along with him on every case under treatment and will be glad to receive your comments or criticism of his method of time study or treatment.

Following the procedure used in the general dentistry program, careful records were kept on time and materials required in each type of operation. (Table II). Later, with the help of trained statisticians acquainted with the use of the proper coefficients for converting the Sturgis experience into terms more suitable to the prevailing demands of experienced orthodontists, the profession will have at its command a mass of data not only on time and materials, but also on indications for treatment and the permanent effects of treatments rendered.

TABLE II. STURGIS TIME STUDY FIRST SIX MONTHS

CLASS	NUMBER OF CASES	PER CENT TOTAL CASES	CHAIR TIME IN MINUTES	LABORATORY TIME IN MINUTES	DIAGNOSIS TIME IN MINUTES	TOTAL TIME IN MINUTES	PER CENT OVER-ALL TIME
C1	11	6.69	41	0	0	41	0.35
C3	95	57.76	708	687	360	1,755	15.297
C4	1	0.60	5	0	0	5	0.043
C5a	30	18.25	3,014	2,957	780	6,751	58.96
C5b	19	11.53	787	967	420	2,172	18.95
C5c	8	4.85	320	253	150	723	6.30
Total	164	99.68	4,875	4,864	1,710	11,447	99.90

It is our hope that fact-finding orthodontic clinics can be organized in numerous localities in the United States so that conclusions can be checked and compared. Until this is done, no claim can be made that anyone has facts assembled which accurately represent the profession.

Five years was arrived at more or less arbitrarily as the minimum time needed to obtain valid data. We were not sure that local interest would continue to support the project. Recently, however, the Sturgis Board of Education, under Dr. L. B. Purdy's leadership, has voted funds for its continuation at any time State funds are withdrawn. This action indicated that local enthusiasm had not been dampened by actual operation of the school clinic. Practicing dentists including orthodontists are frequent visitors at the clinic, but few

objections are raised by them when they understand its purpose. Similar projets we feel certain would be well received wherever they were started.

Is there any good reason why orthodontics does not need this kind of introspection? Is it not, like pedodontics, primarily concerned with child health? In view of the rapidly sharpening focus of Social Security on child health, is it conceivable that our specialty will continue to sit on the sidelines? If not, what better pursuit could we engage in than fact finding as a basis for bargaining?

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919 Oakland Avenue.

A SIMPLIFIED CEPHALOMETRIC HEAD POSITIONER

M. Alden Weingart, D.D.S., New York, N. Y.

TODAY there are prevalent many concepts, theories, and philosophies regarding the logical and practical approach to the orthodontic problem.

Irrespective of the particular concept that one may be following at the moment, it is safe to agree that the cephalometric profile radiograph as a means of diagnostic study and record of accomplishment is here to stay.

Broadbent, with his monumental research, made us realize that a radiographic record of the skull is the only scientific approach to an accurate appreciation of changes that take place in growth and development. Since then, it has been conceded that similar records are also essential in appraising the status of the original malformation as well as changes that may or may not occur during treatment.

Previously produced head positioners or cephalometers were too complicated and costly in their construction to be of practical value to the practicing orthodontist.

Many years of experience in taking cephalometric radiographs have developed a head positioner so simple in design, that it can be constructed by a hobbyist possessing a small precision lathe, or that any machine shop can produce at a reasonable cost.

The positioner is constructed of duralumin weighing approximately three pounds. By choosing standard stock sizes of the material, expensive castings and machining are eliminated.

The unit consists of a head bow, carrying eye-ear pointers; a temporal and occipital stabilizing pad; and a cassette holder. This unit is mounted on a bracket which is attached to the wall and may be swung out of position when not in use. (Figs. 1 and 2).

ESSENTIAL PARTS

a. Head bow	Square rod	$\frac{3}{8}$ inch by $\frac{1}{2}$ inch by 15 inches
b. Eye pointers	Machinist's calipers	
c. Ear plugs	Round rod	$\frac{1}{4}$ inch by $3\frac{1}{2}$ inches
d. Temporal stabilizer	Rubber disk	
e. Occipital stabilizer	Rubber disk	
f. Support for Occipital stabilizer	Strip	$\frac{3}{16}$ inch by $\frac{1}{2}$ inch by 8 inches
g. Support for eye pointer	Round rod	$\frac{1}{4}$ inch by 9 inches

Presented as part of a discourse before the Inaugural Meeting of the Cuban Association of Orthodontists, Havana, Cuba, Feb. 18, 1947; Also presented before the Mexican Orthodontic Association, Mexico City, July 15, 1947, and the Guatemalan Orthodontic Association, Guatemala City, Aug. 18, 1947.

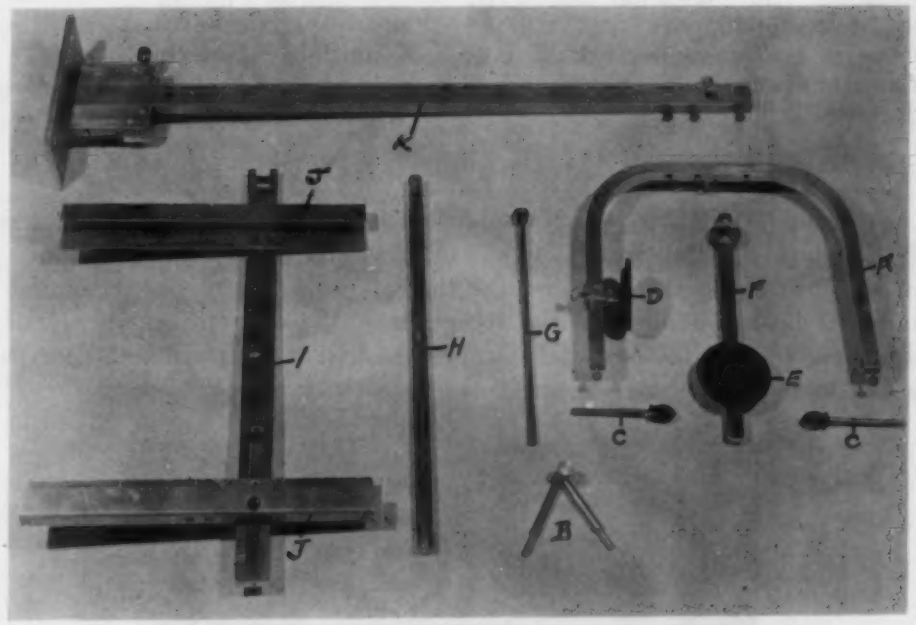

Fig. 1.—Essential Parts. *A*, Head bow; *B*, eye pointers; *C*, ear plugs; *D*, temporal stabilizer; *E*, occipital stabilizer; *F*, occipital stabilizer support; *G*, eye pointer support; *H*, crossbar for occipital and orbital support; *I*, cassette holder support; *J*, cassette channels; *K*, unit supporting bracket.

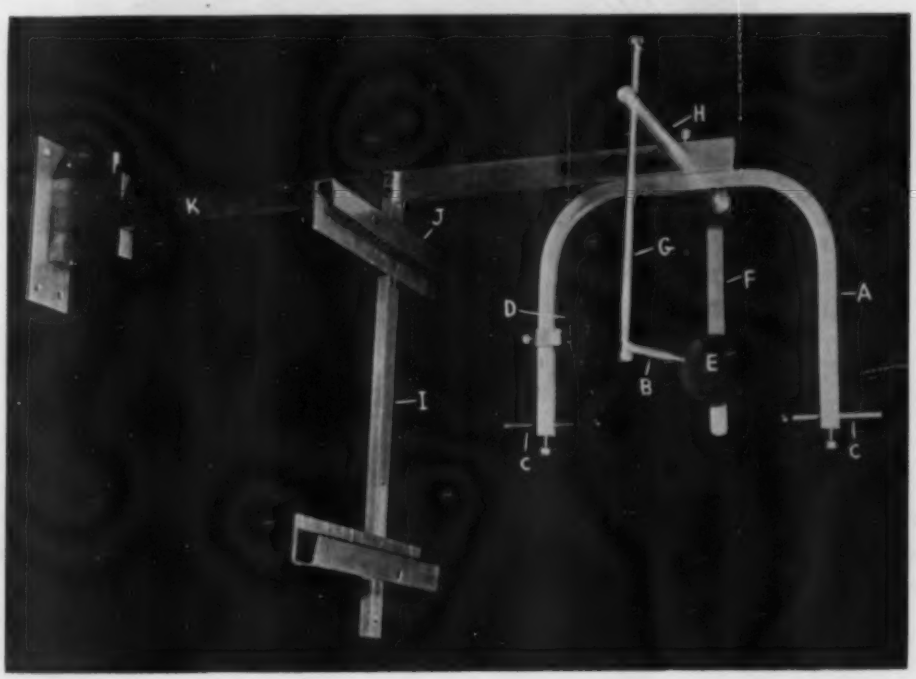

Fig. 2.—The assembled unit. *A*, Head bow; *B*, eye pointers; *C*, ear plugs; *D*, temporal stabilizer; *E*, occipital stabilizer; *F*, occipital stabilizer support; *G*, eye pointer support; *H*, crossbar for occipital and orbital support; *I*, cassette holder support; *J*, cassette channels; *K*, unit supporting bracket.

h. Crossbar for occipital and orbital support	Round rod	¼ inch by 9 inches
i. Cassette holder support	Strip	1 inch by ⅜ inch by 15 inches
j. Cassette channels	Strip	3 inches by ½ inch by 10 inches
k. Supporting bracket	Strip	1 inch by ½ inch by 24 inches

CONSTRUCTION DETAILS

Head Bow.—The rod is bent so that the inside clearance measures seven inches high and eight inches wide. About one inch from each end, one-fourth-inch holes are drilled to receive the ear plugs. In the center of the bow a half-inch hole is drilled for the reception of the crossbar which carries the orbital pointers and the occipital stabilizer pad. The temporal stabilizer pad is attached to the bow above the right ear rod.

Fig. 3.—Cephalometer set for profile exposure.

Ear Plugs.—Two cone-shaped acrylic plugs that rest comfortably in the ear orifices are mounted on one-fourth-inch round rod. These rods are three and one-half inches in length and can be shifted toward each other in a horizontal plane and are locked in position with small thumbscrews.

Orbital Pointers.—These can be made very simply by adapting a pair of machinist's calipers and attaching them to one end of a three-eighths-inch rod. This rod is suspended from the crossbar so that the pointers will rest at a perfect horizontal level for positioning with the ear plugs and can easily be lifted out of view when the exposure is made.

Occipital and Temporal Stabilizing Pads.—Small rubber suction pads which

are used in industry for various purposes make excellent pads; or one may pour them from liquid latex to any desired shape. Provision must be made for the occipital support to slide back and forth on the crossbar in order to accommodate different head sizes.

Cassette Holder.—This section is attached rigidly to the supporting bracket ten inches from the center of the head bow. The channel strips are bent to accommodate the width of the cassette and are attached to the supporting strip so that the cassette will slide easily through the channels. Care must be exercised in mounting the channels on the supporting strip so that the position of the cassette in relation to the head bow will allow sufficient room to clear the soft tissue outline of the face.

Fig. 4.—Resulting profile radiograph showing various diagnostic planes.

Fig. 3 illustrates the ease with which the patient is positioned. Since the head is stabilized against the temporal and occipital rest pads, there is no pressure on the ears or other discomforting adjustments.

Fig. 4 shows resulting radiograph with various cephalometric planes drawn.

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119 West 57th Street.

Editorial

Socialized Medicine

There is so much of the element of common sense revealed in the Brookings report in regard to socialized medicine that its salient points must appeal to all who have given this matter serious thought.

Compulsory health insurance proposals now pending in Congress say, "It would require a high degree of government regulation of medical care, personnel, offer real danger of impaired relations between doctor and patient, would require thousands of additional government employes, and presumably increase the cost of medical care. Moreover, it does not seem probable that politics could be eliminated from medical care supplied under a governmental system."

The Brookings report recommends instead that the federal government concentrate on research, school health education, teaching preventive medicine, acquiring physical facilities, training personnel, and providing care for the indigent. Certainly, these are legitimate functions far removed from the tax idea held by those who want the medical profession put on a prepaid, government-supervised basis.

Had this report stressed the recommendation for special dental care for children, it would have been more comprehensive. However, it may be that this is regarded as another step. Dental care for all children would no doubt be a tremendous undertaking. What if it should include orthodontics? The answer is that such a thing at the present time is impossible because there are not enough trained orthodontists to make even a slight indentation on such a service. In this connection, some people suggest making orthodontic appliances over the model, and sending them to the dentist by mail as a possible means of increasing the scope of orthodontic service for more children. They say this would make available more orthodontic treatment for more children.

Even one who has not gone beyond the basic principles of modern orthodontics knows that precision orthodontics as it is practiced today is not done via the model routine, that such a procedure is regarded as hopelessly amateurish, and that its applications are limited.

The answer to some of these involved child care situations may be in a plan similar to the recently inaugurated expanding program announced by the Army Medical Department:

> The advanced basic science course for medical specialists now underway at the Army Medical Department Research and Graduate School in Washington, D. C., has attracted wide attention in both medical and educational fields since its inauguration in January. Embodying the most modern and effective techniques in post-graduate education, it provides a thorough grounding in various subjects that require special training and experience.

In any event, things are changing rapidly and the Brookings verdict, coming from such an unbiased organization and one of such proved independence, seems to make sense. It contains important and practical suggestions that should be given serious consideration by the professions.

H. C. P.

In Memoriam

HOWARD DENTON KEELER

1873—1948

HOWARD DENTON KEELER pioneered the specialty of orthodontics in Iowa. He was born in Cedar Rapids, Iowa, in 1873 and came to Des Moines with his parents in 1887. Three years after completing his high school education, he entered the Dental Department, State University of Iowa, graduating in 1898.

After graduation, Dr. Keeler spent one year in the office of Dr. J. J. Hughes, one of the leading dentists in Des Moines. He then opened an office of his own and practiced in Des Moines continuously until ill health caused him to discontinue practice.

In 1903, Dr. Keeler graduated from the Angle School of Orthodontia in St. Louis, Missouri, and soon thereafter gave up the general practice of dentistry to specialize in orthodontics in Des Moines.

During World War I, Dr. Keeler was a dental member of the local medical board, serving on that board until the end of the war. He was a member of the Grat Club for many years, and at various times he was a member of the Golf and Country Club and the WaKanda Club. He was president of Hyperian Club during the years 1919 and 1920, a member of the Des Moines District Dental Society, the American Dental Association, and the American Association of Orthodontists.

Department of Orthodontic Abstracts and Reviews

Edited by

Dr. J. A. Salzmann, New York City

All communications concerning further information about abstracted material and the acceptance of articles or books for consideration in this department should be addressed to Dr. J. A. Salzmann, 654 Madison Avenue, New York City

Variations of Tooth Position, A Metric Study of Variation and Adaptation in the Deciduous and Permanent Dentitions: By Carl Michael Seipel, Eastman Institute, Stockholm, Svensk Tandlakare-Tidsskrift (Swedish Dental Journal), Vol. 39, Supplementum from the State Institute of Human Genetics and Race Biology, Upsala. Head: Professor Gunnar Dahlberg, M.D., L.L.D., Lund, Hakun Ohlssons, Boktryckeri, 1946.

A review of the literature pertaining to variations in the position of teeth indicates that malocclusions, i.e., deviations from normal morphology, are to be found in about 50 per cent of the population. The frequency is lower in the temporary dentition, increasing by about one-third in the mixed dentition period, and then tends to recede somewhat with the eruption of the permanent dentition. Malocclusion in the population is shown to consist mainly of (1) crowding which is described as arrested development, lack of growth, and jaw contraction; (2) intermaxillary variations, chiefly in the form of excessive horizontal and vertical overbite; and (3) deviations of molar occlusion, especially of the Angle Class II type. Anomalies of overbite predominate in early childhood while contractions of the jaws are to be diagnosed at a later period.

As early as 1870, one year before Hunter described the normal and anatomical arrangement of the teeth, Mühlreiter stated that there were different forms of normal bite. Seipel sums up the normal bite as one in which all the teeth are intact, in a correct position, and which has every qualification for a perfect function.

The frequency of malocclusion in the population has been estimated to vary from 22 per cent (Talbot, 1890) up to 92.8 per cent (Meyer, 1929) with an average of about 60 per cent. Meyer also found a positive correlation between dental caries and malocclusion.

Seipel measured the sizes of separate teeth, the position of the teeth, and the orientation of the dentition to adjacent parts of the skull. Included were such measurements as transverse dimensions of the dental arch, length of the dental arch, and intermaxillary relations. These measurements were taken on the following three age groups: aged 4 years; aged 13 years; and aged 21 years. Males and females were examined. Sex differences were found with regard to tooth form, jaw size, and to some extent also in tooth position with variations being more pronounced in the age groups from 13 to 21 years. In the 21-year group there was more crowding in the female and more pronounced mesimandibular position of the teeth in males. It was found that there is a pronounced positive correlation with regard to the size of teeth in the same jaw with the different component varying in the same direction in relation to the mean value. Individuals with large incisors also have other teeth of larger than average size.

With regard to variations of tooth position in the dental arch, as can be observed clinically from the crowns of the teeth, it appears that such variations are mainly in the form of spacing, rotations, proximal contact alterations, and

TABLE I. TOOTH SIZE, MESIODISTAL WIDTH IN MM.

Mean Values of Right and Left Side. No. = Number of Individuals Examined. $M \pm \epsilon(M)$ = Arithmetical Mean ± Standard Error of the Mean. σ = Standard Deviation.

	TEMPORARY DENTITION						PERMANENT DENTITION					
	MALES			FEMALES			MALES			FEMALES		
TEETH	NO.	$M \pm \epsilon(M)$	σ	NO.	$M \pm \epsilon(M)$	σ	NO.	$M \pm \epsilon(M)$	σ	NO.	$M \pm \epsilon(M)$	σ
					Upper Jaw							
I_1	205	6.60 ± 0.028	0.41	203	6.56 ± 0.027	0.38	483	8.84 ± 0.025	0.55	490	8.62 ± 0.024	0.53
I_2	224	5.46 ± 0.023	0.35	236	5.36 ± 0.024	0.37	469	6.81 ± 0.028	0.60	476	6.64 ± 0.026	0.57
C	249	7.04 ± 0.025	0.40	250	6.93 ± 0.019	0.30	463	8.10 ± 0.020	0.46	473	7.73 ± 0.019	0.41
P_1	88	7.31 ± 0.041	0.39	85	7.18 ± 0.042	0.38	135	7.18 ± 0.033	0.38	124	7.04 ± 0.035	0.39
P_2	124	8.94 ± 0.044	0.49	120	8.79 ± 0.037	0.40	125	6.97 ± 0.035	0.39	115	6.85 ± 0.040	0.43
M_1							164	10.69 ± 0.038	0.48	135	10.47 ± 0.045	0.52
M_2							151	10.47 ± 0.053	0.65	176	10.05 ± 0.044	0.58
M_3							33	9.48 ± 0.170	0.98	7	8.33	
Σ Inc.		24.05 ± 0.051			23.82 ± 0.051			31.25 ± 0.075			30.45 ± 0.072	
$I_1 + I_2 + C$		19.10 ± 0.044			18.85 ± 0.041			23.75 ± 0.043			22.99 ± 0.040	
$I_1 - P_2$		35.35 ± 0.075			34.82 ± 0.069			37.90 ± 0.064			36.88 ± 0.067	
$I_1 - M_2$								59.06 ± 0.092			57.40 ± 0.092	
Height I_1	237	5.52 ± 0.037	0.57	240	5.43 ± 0.035	0.55	255	9.68 ± 0.054	0.87	243	9.32 ± 0.057	0.88
					Lower Jaw							
I_1	242	4.25 ± 0.020	0.32	241	4.16 ± 0.016	0.25	507	5.51 ± 0.016	0.36	491	5.42 ± 0.017	0.37
I_2	247	4.86 ± 0.022	0.35	248	4.81 ± 0.020	0.32	507	6.13 ± 0.018	0.40	493	5.94 ± 0.017	0.37
C	250	6.04 ± 0.029	0.32	250	5.92 ± 0.021	0.33	503	7.12 ± 0.017	0.39	493	6.69 ± 0.017	0.38
P_1	124	8.00 ± 0.041	0.46	123	7.85 ± 0.037	0.41	160	7.27 ± 0.029	0.37	146	7.16 ± 0.033	0.40
P_2	136	9.94 ± 0.041	0.48	151	9.80 ± 0.041	0.51	103	7.41 ± 0.040	0.41	117	7.21 ± 0.036	0.39
M_1							145	11.24 ± 0.047	0.57	123	10.98 ± 0.055	0.61
M_2							241	11.15 ± 0.041	0.69	275	10.70 ± 0.039	0.64
M_3							52	11.32 ± 0.120	0.84	11	10.30	
Σ Inc.		18.22 ± 0.041			17.96 ± 0.037			23.24 ± 0.046			22.39 ± 0.047	
$I_1 + I_2 + C$		15.15 ± 0.036			14.89 ± 0.033			18.47 ± 0.029			18.05 ± 0.029	
$I_1 - P_2$		33.09 ± 0.068			32.54 ± 0.064			33.44 ± 0.058			32.42 ± 0.057	
$I_1 - M_2$								55.83 ± 0.086			54.10 ± 0.088	
Height I_1	243	4.98 ± 0.033	0.52	242	4.88 ± 0.031	0.48	255	8.33 ± 0.051	0.82	243	8.21 ± 0.046	0.71

TABLE II. VARIATIONS OF TOOTH-SIZE (MES.-DIST. CROWN-WIDTH) IN THE PERMANENT DENTITION
Variations Expressed in Arithmetic Mean (= M) and Standard Deviation (= σ).

TEETH		MEAN	M − σ						M + σ					
			−3 σ	−2.5 σ	−2 σ	−1.5 σ	−σ	−0.5 σ	+0.5 σ	+σ	+1.5 σ	+2 σ	+2.5 σ	+3 σ
Males	I_1	8.84	7.19	7.46	7.74	8.01	8.29	8.56	9.12	9.39	9.67	9.94	10.22	10.49
Upper jaw	I_2	6.81	5.01	5.31	5.61	5.91	6.21	6.51	7.11	7.41	7.71	8.01	8.31	8.61
	C	8.10	6.72	6.95	7.18	7.41	7.64	7.87	8.33	8.56	8.79	9.02	9.25	9.48
	P_1	7.18	6.04	6.23	6.42	6.61	6.80	6.99	7.37	7.56	7.75	7.94	8.13	8.32
	P_2	6.97	5.80	5.99	6.19	6.38	6.58	6.77	7.17	7.36	7.56	7.75	7.95	8.14
	M_1	10.69	9.25	9.49	9.73	9.97	10.21	10.45	10.93	11.17	11.41	11.65	11.89	12.13
	M_2	10.47	8.52	8.84	9.17	9.49	9.82	10.14	10.80	11.12	11.45	11.77	12.10	12.42
Lower jaw	I_1	5.51	3.92	4.18	4.45	4.71	4.98	5.24	5.78	6.04	6.31	6.57	6.84	7.10
	I_2	6.13	4.42	4.70	4.99	5.27	5.56	5.84	6.42	6.70	6.99	7.27	7.56	7.84
	C	7.12	5.89	6.09	6.30	6.50	6.71	6.91	7.33	7.53	7.74	7.94	8.15	8.35
	P_1	7.27	6.10	6.29	6.49	6.68	6.88	7.07	7.47	7.66	7.86	8.05	8.25	8.44
	P_2	7.41	6.12	6.33	6.55	6.76	6.98	7.19	7.63	7.84	8.06	8.27	8.49	8.70
	M_1	11.24	9.68	9.94	10.20	10.46	10.72	10.98	11.50	11.76	12.02	12.28	12.54	12.80
	M_2	11.15	9.41	9.70	9.99	10.28	10.57	10.86	11.44	11.73	12.02	12.31	12.60	12.89
Females	I_1	8.62	7.54	7.72	7.90	8.08	8.26	8.44	8.80	8.98	9.16	9.34	9.52	9.70
Upper jaw	I_2	6.64	5.44	5.64	5.84	6.04	6.24	6.44	6.84	7.04	7.24	7.44	7.64	7.84
	C	7.73	6.56	6.75	6.95	7.14	7.34	7.53	7.93	8.12	8.32	8.51	8.71	8.90
	P_1	7.04	5.93	6.11	6.30	6.48	6.67	6.85	7.23	7.41	7.60	7.78	7.97	8.15
	P_2	6.85	5.62	5.82	6.03	6.23	6.44	6.64	7.06	7.26	7.47	7.67	7.88	8.08
	M_1	10.47	8.76	9.04	9.33	9.61	9.90	10.18	10.76	11.04	11.33	11.61	11.90	12.18
	M_2	10.05	7.98	8.32	8.67	9.01	9.36	9.70	10.40	10.74	11.09	11.43	11.78	12.12
Lower jaw	I_1	5.42	4.31	4.49	4.68	4.86	5.05	5.23	5.61	5.79	5.98	6.16	6.35	6.53
	I_2	5.94	4.83	5.01	5.20	5.38	5.57	5.75	6.13	6.31	6.50	6.68	6.87	7.05
	C	6.69	5.55	5.74	5.93	6.12	6.31	6.50	6.88	7.07	7.27	7.45	7.64	7.83
	P_1	7.16	5.96	6.16	6.36	6.56	6.76	6.96	7.36	7.56	7.76	7.96	8.16	8.36
	P_2	7.21	6.04	6.23	6.43	6.62	6.82	7.01	7.41	7.60	7.80	7.99	8.19	8.38
	M_1	10.98	9.15	9.45	9.76	10.06	10.37	10.67	11.29	11.59	11.90	12.20	12.51	12.81
	M_2	10.70	8.78	9.17	9.42	9.78	10.06	10.38	11.02	11.34	11.62	11.98	12.23	12.62

changes following the loss of teeth. In the deciduous dentition, spacing predominates while crowding is to be found more frequently in the permanent dentition. The frequency of spacing is higher in the upper jaw while crowding appears more frequently in the lower jaw. In the deciduous dentition spacing is comparatively evenly distributed. At the age of 4 years the maxilla shows minimum spacing especially about the canine region which has been called a primate type of spacing. In the permanent dentition, spacing is usually localized between the canines and first premolar and between the second central incisors in the upper jaw.

Crowding in the adult permanent dentition is to be found in the third molar region. Anterior to the first molars crowding is found in the deciduous dentition about the incisor and canine regions. In the early permanent dentition, crowding is usually to be observed in the canine regions of the maxillary jaw and is more pronounced in males than in females. In the mandibular jaw, crowding is more often localized about the second premolar and incisors. Crowding about the lower second premolars is more common in males than in females. An interesting observation is made about such mandibular crowding. It appears to be a transitional phenomenon which is considerably reduced in the 21-year group. Mandibular canines and incisors, on the other hand, show a tendency to increase in crowding as age increases. The most frequent sites for crowding are given as follows: at age 4 years minimum crowding and rotation of the mandibular incisor region; at age 13 years crowding of the later erupting permanent teeth; at age 21 years increasing crowding of the anterior region especially of the mandibular jaw.

Spacing and crowding in the same jaw are accidental symptoms due to tooth migration and defective eruption in the permanent dentition. In the deciduous dentition such crowding and spacing in the same jaw is accepted as a frequently occurring deviation. Rotation of teeth is usually concomitant of crowding but occurs also in cases where the space usually allotted for a tooth is so large as to interfere with proximal contact. While rotations occur in 4 per cent of deciduous dentitions, it is to be observed in almost 15 per cent of permanent dentitions.

Changes in the position of the teeth following extraction confirm Salzmann's findings published in 1938. It was shown at that time that second molar teeth adjacent to extracted first molars migrate forward especially in the maxillary jaw, while the premolars show distal migration especially in the lower jaw. There is a distal migration of anterior teeth with an increase of spacing and a decrease of crowding. The dental migration is more pronounced in the lower jaw.

Closure of space in the deciduous dentition is slow while in the permanent dentition it is faster and more definite. While only 10 per cent of the spaces in the deciduous dentitions are found to close fully, 50 per cent of the spaces in the permanent dentitions show closure. A pronounced correlation was found between molar and incisor relations. Jaw malocclusions are found to be less frequent than malocclusions due to arch relationship. The significant factor is that intermaxillary relationship is of a stable, individual character which tends to be maintained during tooth change and jaw growth.

In conclusion, Seipel shows that while frequent positional variations of spacing and crowding appear in size-space, disturbances there are also specific from variations which appear independent of available space in the jaws. Seipel has presented an account of variations of tooth position and tooth size which will be found of value to workers in the field of orthodontic research as well as to practicing orthodontists. Some of the contributions which have been made during the past ten years bearing on this subject by Americans have not been included. Seipel's findings are an extremely valuable contribution to the orthodontic literature.

News and Notes

Meeting of the American Association of Orthodontists

THIS IS THE LAST WORD

HAVE YOU HOTEL RESERVATIONS?

A number of desirable rooms are still available at the Deshler-Wallick Hotel. *It is imperative that you make reservations at once.* Owing to the crowded program, no noonday luncheons have been scheduled.

Deshler-Wallick Hotel

Neil House

Sunday, April 25

Registration, 1:00—5:00 P.M., main lobby, Neil House.

Monday, April 26, Good Fellowship Day

Registration, 9:00 A.M.—5:00 P.M.

12 noon — Busses leave for Columbus Country Club for the American Association of Orthodontists' Championship Golf Tournament.

6:00—7:00 P.M. — Hospitality hour, Grand Ballroom, Neil House.

7:00 P.M. — Stag banquet and floor show, Grand Ballroom, Neil House. Golf prizes and door prizes will be awarded.

Tuesday, April 27

Registration, 9:00 A.M.—5:00 P.M.

9:00 A.M. — Address of welcome, Lieutenant Governor Paul M. Herbert.

9:30 A.M.—12 noon — Scientific program, Grand Ballroom, Neil House.

2:00—4:30 P.M. — Scientific program, Grand Ballroom, Neil House.

4:30—8:00 P.M. — Time to greet old friends and make new ones.

8:00 P.M. — Grand Ballroom, Neil House, Chapel Choir of Capital University under the direction of Prof. Ellis Snyder will entertain members and their guests.

8:30 P.M. — President's report.

8:45—9:15 P.M. — Ketcham Award.

9:15 P.M. — Research paper.

Wednesday, April 28

	9:00 A.M.—5:00 P.M., registration, main lobby, Neil House.
9:00 A.M.—12 noon	Scientific program, Grand Ballroom, Neil House.
2:00—4:30 P.M.	Scientific program, Grand Ballroom, Neil House.*
6:30 P.M.	Formal Reception honoring President Earl G. Jones and Mrs. Jones.
7:15 P.M.	Dinner dance, Grand Ballroom, Neil House.

Thursday, April 29

	9:00 A.M.—12 noon, registration, main lobby, Neil House.
9:00 A.M.—12 noon	Scientific program, Grand Ballroom, Neil House.
2:00—5:00 P.M.	Clinics in Grand Ballroom, Neil House.

LADIES' ACTIVITIES

Monday, April 26

6:30 P.M.	Informal reception at Deshler-Wallick Hotel.
7:00 P.M.	Buffet dinner, Deshler-Wallick Hotel. Book review by The Rev. Mr. James Dyar Moffett.

Tuesday, April 27

2:45 P.M.	Complimentary tour of Ohio State University Campus. Busses leave Neil House at 2:45 P.M. *sharp.* Tea at Faculty Club.
8:00 P.M.	Grand Ballroom, Neil House, Chapel Choir of Capital University under the direction of Prof. Ellis Snyder will entertain members and their guests.

Wednesday, April 28

2:15 P.M.	Matinee at Hartman Theater. Name of play to be announced later. Information concerning tickets at registration desk.
6:30 P.M.	Formal reception honoring President Earl G. Jones and Mrs. Jones.
7:15 P.M.	Dinner dance, Grand Ballroom, Neil House.

The convention committee and Columbus hotels are ready. They need only *you* and your presence to reward them for their efforts in planning for you through the past months.

Tickets for all entertainment activities are limited. *First come—first served.* Don't be disappointed. Please write for your desired reservations at once.

FRED'K R. ALDRICH, Chairman.

American Association of Orthodontists

Local Committees for 1949 Convention, May 2-5, Hotel Commodore, New York

Advisory to the President

(Consisting of members from each district society)

Henry U. Barber, Chairman	G. Vernon Fisk	H. C. Pollock
Archie Brusse	William Humphrey	Alfred Rogers
Ernest Bach	Hays Nance	Paul Spencer
Joseph Eby	James McCoy	T. W. Sorrels
Max Ernst	William Murray	Leuman Waugh
Leigh Fairbank	Oren Oliver	Ralph Waldron

*We regret that the mention of Dr. E. C. Lunsford, who will speak on the subject, "Treatment Planning and Treated Cases," on Wednesday, April 28, 3:30 p.m., was omitted from the program of the meeting which appeared in the March issue of the JOURNAL.

Program

Franklin Squires, Chairman — Sidney Reisner — Leuman Waugh

General Arrangements

(Chairmen of local committees and local members of Advisory Committee)

George Callaway, Chairman — Jerome Trier, Treasurer — Leuman Waugh
Henry U. Barber — Oscar Jacobson — Ralph Waldron
Walter Bedell — William Keller — Raymond Webster
Joseph Eby — Richard Lowy — Glenn Whitson
Norman Hillyer — Franklin Squires — Glenn Young
Ashley Howes — Donald Waugh — J. A. Salzmann
Leigh Fairbank

Local Arrangements

William Keller, Richard Lowy, Henry U. Barber } Chairmen — George Callaway — Donald Hutchinson
C. Sterling Conover — Edward G. Murphy

Registration

Glenn Whitson, Chairman — Max Ernst — Lewis Jackson
Walter Chapin — Clifford Glaser — M. B. Markus
Herbert Ernst — Samuel Hemley — Charles Spahn
Arthur Totten

Editorial and Publicity

J. A. Salzmann, Chairman — Fred Blumenthal — Stephen Hopkins
Joseph Eby — H. C. Pollock

Commercial Exhibits

Jerome Trier, Chairman — Michael Maxian — Clinton Van Natta

Reception

Raymond Webster, Chairman — Gerald Franklin — Donald Osborne
Fred Blumenthal — Geneva Groth — Charles Patton
George Caddick — Andrew Jackson — John Ross
Leigh Fairbank — Alonzo McClelland — Robert Strang
G. Vernon Fisk

Banquet

Ashley Howes, Chairman — Eugene Kelly — Wilbur Prezzano
John Dolce — Frank Nicolai — Anna Urban
Augustus Holt

International Luncheon Committee

Leigh Fairbank, Chairman — Andrew Jackson — John Ross
Spencer Atkinson — E. C. Lunsford — Glenn Young

Entertainment

Walter Bedell, Chairman — Leigh Fairbank — Clare Madden
Stanley Dow — Harry Jerrold — Donald Waugh

Ladies' Entertainment

Norman Hillyer, Chairman — Donald Hutchinson — Otto Sorenson

Ladies' Executive

Mrs. Lowrie J. Porter, Chairman
Dr. Josephine Abelson
Mrs. Henry Barber
Mrs. Ashley Howes
Mrs. Norman Hillyer
Mrs. Donald Hutchinson
Mrs. Franklin Squires
Mrs. Donald Waugh
Mrs. Leuman Waugh
Mrs. Raymond Webster

Ladies' Auxiliary

(Consisting of wives of local committee members)

Mrs. Lowrie J. Porter, Chairman
Dr. Josephine Abelson
Mrs. James Allan
Mrs. Henry Barber
Mrs. Walter Bedell
Mrs. George Callaway
Mrs. Walter Chapin
Mrs. C. Sterling Conover
Mrs. John Dolce
Mrs. Stanley Dow
Mrs. Herbert Ernst
Mrs. Bertram Gerzog
Mrs. Samuel Hemley
Mrs. William Hillis
Mrs. Norman Hillyer
Mrs. Augustus Holt
Mrs. Ashley Howes
Mrs. Donald Hutchinson
Mrs. Lewis Jackson
Mrs. Oscar Jacobson
Mrs. Harry Jerrold
Mrs. William Keller
Mrs. Eugene Kelly
Mrs. Richard Lowy
Mrs. Michael Maxian
Mrs. Edward Murphy
Mrs. Frank Nicolai
Mrs. Wilbur Prezzano
Mrs. J. A. Salzmann
Mrs. Otto Sorenson
Mrs. Franklin Squires
Mrs. Charles Spahn
Mrs. Arthur Totten
Mrs. Jerome Trier
Mrs. Alexander Ungar
Mrs. Ralph Waldron
Mrs. Donald Waugh
Mrs. Leuman Waugh
Mrs. Glenn Whitson
Mrs. Glenn Young

Boat Trip and Bus to Campfire Club

Oscar Jacobson, Chairman
Bertram Gerzog
Alexander Ungar

Sports

(Campfire Club)

Donald Waugh, Chairman
James Allan
Henry U. Barber
Joseph Eby
William Hillis
Leuman Waugh
Glenn Young

American Board of Orthodontics

The 1948 meeting of the American Board of Orthodontics will be held at the Deshler-Wallick Hotel, Columbus, Ohio, April 23, 24, 25, and 26. Orthodontists who may desire to be certificated by the Board may obtain application blanks from the Secretary, Dr. Bernard G. deVries, 705 Medical Arts Building, Minneapolis 2, Minnesota.

Central Section of the American Association of Orthodontists

The regular annual meeting of the Central Section of the American Association of Orthodontists will be held Oct. 25 and 26, 1948, at the Corn Husker Hotel, Lincoln, Nebraska.

European Orthodontic Society

The dates of the meeting of the European Orthodontic Society have been changed to Friday, Saturday, and Monday, July 16, 17, and 19, 1948. The change was made for the convenience of European colleagues and because of the meeting of the American Dental Society

of Europe, which will be the following Monday, July 26. It is hoped that many American friends and colleagues will be able to attend.

Inquiries should be sent to the Honorary Secretary,

Mr. L. Russell Marsh
19, Harcourt House,
19, Cavendish Square,
London, W. 1.

or to the Honorary Treasurer,

Dr. O. Henry
11B, Portland Place,
London, W.1.

Notes of Interest

Dr. Harold Chapman, Esquire, L.D.S., R.C.S., of London, England, has been elected to Fellowship in Dental Surgery of the Royal College of Surgeons. This recognition was given to Dr. Chapman for distinguished service in dental surgery in general and orthodontics in particular.

Irving Kraut, D.D.S., wishes to announce the opening of his offices at 375 West State Street, Trenton, N. J., practice limited to orthodontics.

Dr. Thad Morrison, Sr., announces the association of his son, Dr. Thad Morrison, Jr., in the exclusive practice of orthodontics at 353 Doctors Building, North Court, Atlanta, Georgia.

Colonel Lou Renfrow was recently appointed by the President of the United States to be Assistant Military Aid to the President and Assistant Coordinator of Veterans' Affairs. This is the first time a dental officer of the military services has been so appointed.

Orval B. Sessums, D.D.S., announces the opening of his office at 610 San Angelo National Bank Building, San Angelo, Texas, practice limited to orthodontics.

OFFICERS OF ORTHODONTIC SOCIETIES

The AMERICAN JOURNAL OF ORTHODONTICS AND ORAL SURGERY is the official publication of the American Association of Orthodontists and the following component societies. The editorial board of the AMERICAN JOURNAL OF ORTHODONTICS AND ORAL SURGERY is composed of a representative of each one of the component societies of the American Association of Orthodontists.

American Association of Orthodontists

President, Earl G. Jones - - - - - - - - - - - 185 East State St., Columbus, Ohio
President-Elect, Lowrie J. Porter - - - - - - - - - 41 East 57th St., New York, N. Y.
Vice-President, G. Vernon Fisk - - - - - - 818 Medical Arts Bldg., Toronto, Ont., Can.
Secretary-Treasurer, Max E. Ernst - - - - 1250 Lowry Medical Arts Bldg., St. Paul, Minn.

Central Section of the American Association of Orthodontists

President, Ralph G. Bengston - - - - - - - - - 25 E. Washington St., Chicago, Ill.
Secretary-Treasurer, Earl E. Shepard - - - - - - - - - 4500 Olive St., St. Louis, Mo.

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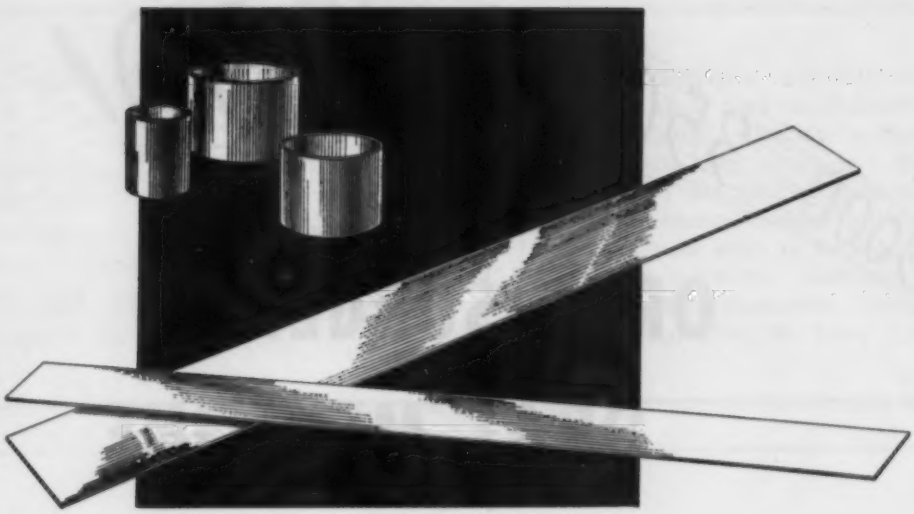

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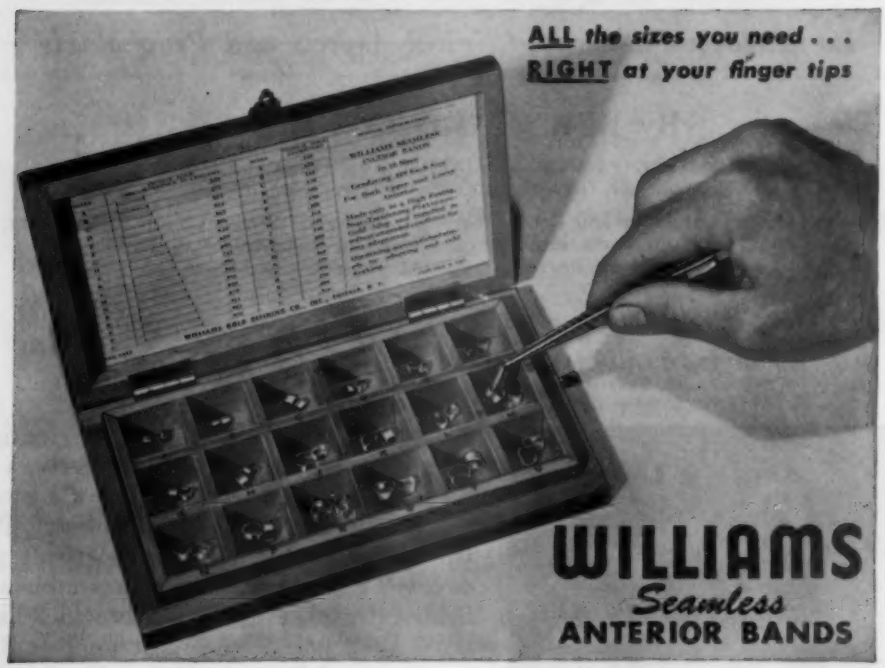

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